

SPECIAL SERVICE FEATURE ISSUE

RADIO & TELEVISION NEWS

**MARCH
1965**

38 CENTS
In U.S. and Canada

World's Leading Electronics Magazine

IN THIS ISSUE

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RCA COLOR RECEIVER**

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TV SERVICE LICENSING**

**NEW BRITISH POWER
AMPLIFIER**

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A.C.-D.C. RADIO SERVICING**

**NEW TV AND RADIO
TEST EQUIPMENT**

**LOUDSPEAKERS—
THE WEAKEST AUDIO LINK**

NARROW-BAND SPEECH UNIT

DEVELOPMENTS IN U.H.F.

MOBILE TV REPAIR ♦
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"Up to our necks in Radio-Television work. Four other NRI men work here. Am happy with my work."—Glen Peterson, Bradford, Ont., Canada.



"Am doing Radio and Television Servicing full time. Now have my own shop. I owe my success to N.R.I."—Curtis Stath, Ft. Madison, Iowa.

"Am with WCOC. NRI course can't be beat. No trouble passing 1st class Radio-phone license exam."—Jesse W. Parker, Meridian, Mississippi.



"By the time I graduated I had paid for my course, a car and testing equipment. Can service toughest jobs."—E. J. Streitenberger, New Boston, Ohio.

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You benefit by my 40 years' experience training men at home. Well illustrated lessons give you basic principles you need. Skillfully developed kits of parts I send (see below) "bring to life" things you learn from lessons.

You Learn by Practicing with Parts I Send



Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use parts I furnish to build many circuits common to Radio and Television. As part of my Communications Course, you build many things, including low power transmitter shown at left. You put it "on the air," perform procedures required of broadcasting operators. With my

Servicing Course you build modern Radio, etc. Use Multitester you build to make money fixing sets. Many students make \$10, \$15 week extra fixing neighbors' sets in spare time while training. Coupon below will bring book showing other equipment you build. It's all yours to keep.

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About 200 Television stations are now on the air. Hundreds of others being built. Good TV jobs opening up for Technicians, Operators, etc.



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COVER PHOTO: Mobile TV of Tempo, Arizona has developed a profitable business by taking its shop to the customer. According to all reports, servicing is expedited and customers are vocally appreciative. (Ektachrome by Willis L. Peterson)

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RADIO & TELEVISION NEWS



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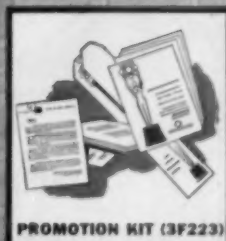


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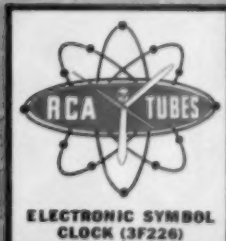
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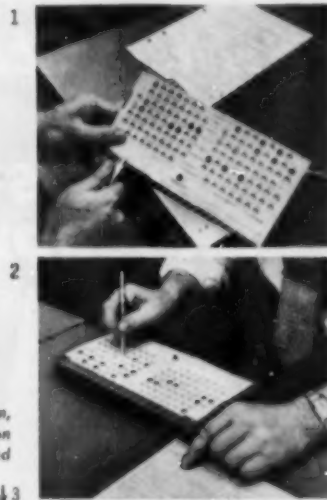
TEST EQUIPMENT
 AWARDS



A "TRIBUTE" IN LIFE

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Perforated steel cards, which give directions to the Long Distance dial telephone system, are easy to keep up to date. New information is clipped (1) and punched (2) by hand on a cardboard template. This guides the punch-press that perforates a steel card (3), and the two are checked (4). The new card is put into service in the card translator (5).



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Route information is supplied in code—as holes punched on steel cards. When a call comes in, the dial system selects the appropriate card, then reads it by means of light beams and phototransistors. Should the preferred route be in use the system looks up an alternate route.

It is a simple matter to keep thousands of cards up to date when new switching points are added or routing patterns are changed to improve service. New cards are quickly and easily punched with the latest information to replace out-of-date cards.

This efficient, flexible way of keeping your dial system up to the minute was devised by switching engineers of Bell Telephone Laboratories, who are continually searching for ways to improve service and to lower costs. Right now most of the Long Distance dialing is done by operators, but research is hastening the day when you will be able to dial directly to other telephones all over the nation.



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For the **RECORD.**

BY THE EDITOR

WILL TOMORROW'S RADIO NEED SERVICING?

THE process of servicing electronic components has been well defined for many years. The techniques established include tube replacement, capacitor replacement, intermittent location, and the locating of shorts, to name but a few. Normally, breakdowns of tubes and components are the result of heat, wear, vibration, or high voltage. Radio sets, TV sets, and hi-fi equipment all have similar tube failures and breakdowns. In fact, all electronic equipment that relies on the vacuum tube for its functioning is plagued by the same limitations.

An entirely new concept of equipment design is about to emerge from the laboratories which, in time, will have far-reaching effects on our present methods of servicing. The ravages of high voltage and temperatures, of shock and vibration, and short-lived filaments will be eliminated by the comparatively modest requirements of the transistor.

More and more transistorized equipment for consumer use is being seen each month. No longer is wide-spread use of the transistor confined to the hearing aid. And no longer does the engineer concentrate wholly on miniaturization in an attempt to design wristwatch radios and similar tiny devices to catch the public's fancy.

There are many highly practical uses for the transistor that appear to greatly outshadow the possibilities for miniaturized novelty items. Perhaps the greatest (at the moment) is the conventional auto radio with its severe demands for power to make it operate. Sticking vibrators, hum, hash, vibration, long warm-up, and physical bulk have plagued the technician and consumer for many years.

A transistorized auto radio, on the other hand, requires no vibrator or other high-voltage "B" supply. And there is nothing to cause audible hum. Self-induced "hash" is forgotten and there are no filaments to warm up. Even without any attempt to use special miniature parts, the transistor auto set can be made very compact and to compatible shapes to easily fit the dash of any automobile.

The greatest advantage, however, is the ability of a transistor auto radio to possess adequate gain, freedom from microphonics, good sensitivity, and up to several watts of good, clean audio—all from the 6- or 12-volt storage battery.

Costly components can be eliminated, including the vibrator, rectifier, and transformer. In some designs, the output transformer will be done away

with and transistors will be coupled directly to the loudspeaker voice coil. Sockets will be a thing of the past because the life expectancy of the transistor would permit "mile-for-mile" use with any automobile made. There could be many useful hours of service left in a transistor—after the auto reached the scrap pile.

We'll venture a guess that a new concept of auto antenna technique will be developed. A short hollow rod, instead of the long whip, will contain an r.f. stage of wide-band characteristic employing a single transistor. A simple coax cable will deliver the amplified signal to the auto set as well as carry the necessary low voltage to power the transistor. A ferrite stick might be an advantage over the rod.

The all-transistor auto radio would require a modest total drain of about 30 ma. for average output instead of 10 amperes. The same receiver could be used as a portable or home set—operated from standard flashlight cells. Class B audio will probably be universally used because of low-drain requirements and because of high-efficiency (78% or more) capabilities. Distortion in class B stages can be held well below 5% with feedback. That's good enough for an auto set using small loudspeakers for reproduction.

Servicing requirements for an all-transistor auto radio would pose no special problems. Capacitor breakdowns would be rare (at 6 or 12 volts). Oscillator drift would not occur as a result of generated heat (from vacuum tubes, etc.), and testing of circuits would be simplified by "printed circuit boards." Sockets would not be required—the transistor leads all spot welded for permanent use (up to 100,000 hours).

The cost of an all-transistor auto receiver should eventually be considerably below present types as a result of labor and component savings and from exclusive application of printed circuit techniques. Service (if ever needed) will be a simple process compared to today's automobile radio receiver servicing.

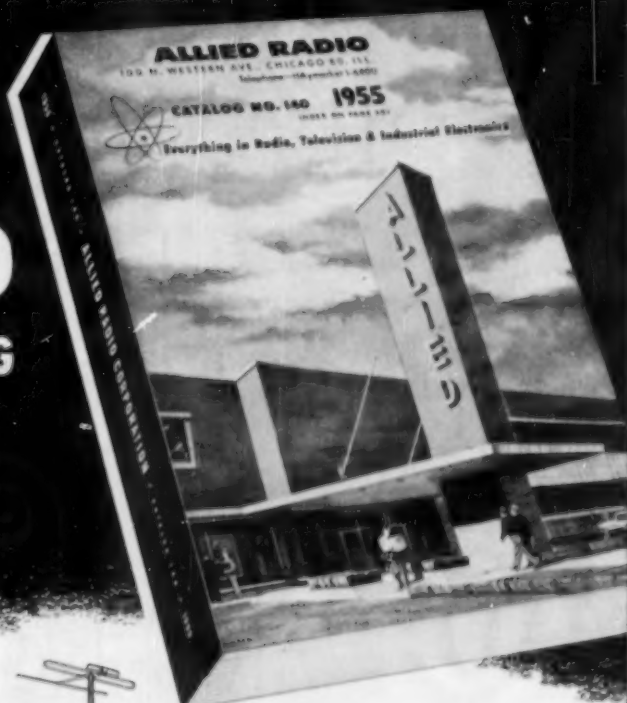
It is entirely possible to manufacture a transistorized radio set today that could operate continuously for the next ten or eleven years without maintenance. The operating cost would be but a fraction of a cent per hour for batteries.

In the meantime, and for years to come, there is and will be plenty of troubleshooting required on millions of vacuum-tube operated equipments for the service technician. . . . O.R.

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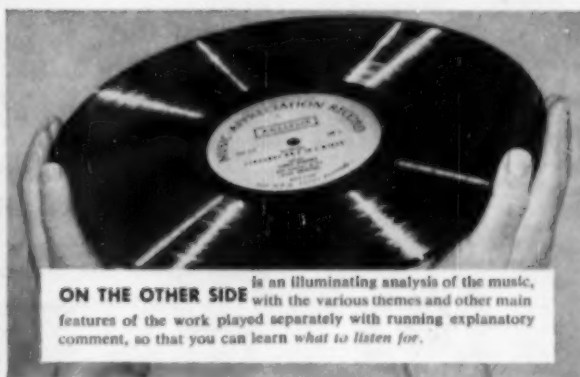
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will be of two kinds: first, a so-called Standard Record - a twelve-inch disc - which will present the performance on one side, the analysis on the other. This will be sold at \$3.60, to subscribers only. The other will be an Analysis-Only Record - a ten-inch disc - priced at \$2.40. The latter will be made available each month for any subscriber who may already have a satisfactory long-playing record of the work being presented. (A small charge will be added to the prices above to cover postage and handling.)

TRY A ONE-MONTH SUBSCRIPTION - WITH NO OBLIGATION TO CONTINUE . . . Why not make a simple trial, to see if these records are as pleasurable and as enlightening as you may anticipate? The first record, BEETHOVEN'S FIFTH SYMPHONY, will be sent to you at once - at no charge. You may end this subscription immediately after hearing this record - and keep it with our compliments - or you may cancel any time thereafter if you are not completely satisfied with the plan.

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A NEW HIGH-FIDELITY RECORDING BY THE LONDON SYMPHONY ORCHESTRA

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Analysis by Thomas Scherman

YOU will also receive a **DESCRIPTIVE ESSAY** about the work by the noted composer and music commentator Deems Taylor, as well as a **GLOSSARY OF MUSICAL TERMS** COMMONLY USED.

March, 1955



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MAR 8

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NEW 12AU7A

- shorter construction reduces intermittent scan and heater cathode failures.
- completely interchangeable with Type 12AU7.



NEW 5U4GB

- twin-wing plates provide greater heat dissipation.
- wafer stem strengthens construction. Increases ratings to 275 Ma at 44V drop with 1.0 amp. peak plate current.

Sylvania makes important NEW advances in

WAR ON CALL-BACKS

Six "double-duty" tubes designed to lick TV service's costliest problems. More to come!

Sylvania's war against callbacks began with the highly improved 5U4GB tube. Now Sylvania continues its fight against profit-grabbing callbacks and offers five more improved types for TV service.

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Look for the new "double-duty" types in this yellow-and-black carton. It's your calling card of quality.

NEW 1X2B

- all-nickel plates reduce electrolysis. Lower gas level results in higher breakdown voltage.
- longer life-test under conditions well above ratings.



NEW 6BQ6GT

- folded-edge plate design avoids bulb bombardment.
- double-clearance between mount and bulb top eliminates the "pigtail" to grid shorts. Avoids bulb-puncturing electron bombardment.



NEW 1B3GT

- electrostatic shield-ring protects filament during high-voltage operation.
- Sylvania-developed top-cap alloy produces positive glass-to-metal seal.
- high-voltage base makes tube interchangeable with coated types.



NEW 6SN7GTB

- oblique orientation of sections reduces microphonism.
- direct weld between stem pins and plates strengthens mount.



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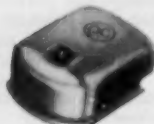
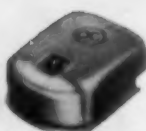
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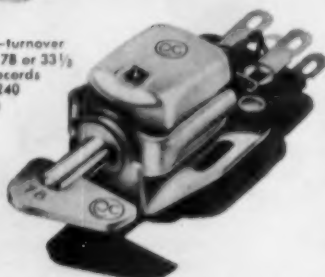
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mounted back-to-back to make up the famous
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MODEL 220—for 78 rpm records;
diamond or sapphire stylus



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MODEL 260—turnover
cartridge for 78 or 33 1/3
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The **220** and **240** are engineered to
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are without equal ...

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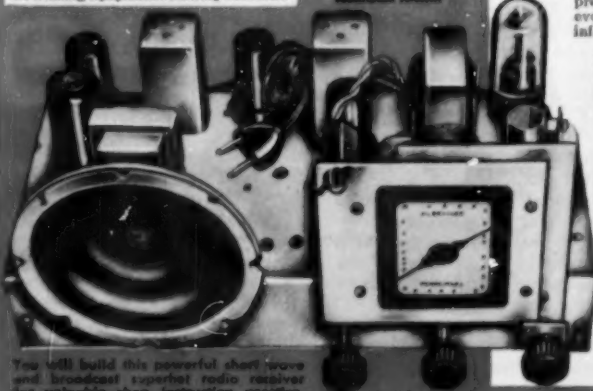


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professional gear-drive model

Here's the turntable that is the fast-growing choice of discriminating music lovers and technicians. It has all the quality of turntables costing twice as much. The cast-aluminum table, with foam rubber cover, is powered by the modern Thorens direct-drive motor... world's most silent phono motor. A mechanical filter assures continued silent operation... an electronically-balanced rotor shaft eliminates undesirable waver and wow. In standard signal-to-dead-groove noise level checks, the E-53 PA maintains a noise level of -48 db. Has convenient speed change.

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for the E-53 PA, as well as
Thorens automatic and
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Spot Radio News

* Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS'
WASHINGTON EDITOR

FCC'S ANNUAL REPORTS are always husky, impressive volumes, bulging with unusual information. The latest edition (covering the period ending June 30, 1954), issued the day after the New Year was ushered in, is outstanding and will be sought by many, for it is an anniversary issue, highlighting the twentieth birthday of the Commission.

Bristling with facts, the compilation reveals, for instance, that the nation is now being served by over 700,000 non-broadcast transmitters; 44,000 in the marine bracket; 42,000 in use by the aviation industry; 146,000 by industrial; 165,000 by public safety stations; 139,000 by land-transportation stations; 116,000 by hams; 1600 by common carriers; and nearly 600 by experimental operators. In addition, there were nearly 6000 broadcast-station authorizations on the books with over 2600 recorded for AM, and 569 for FM, the only service that had shown a decline; in 1949, the peak year, 865 FM stations had received OK's to operate. In an effort to help FM, economically, the Commission has proposed that stations be permitted to render supplemental services such as functional music, storecasting, and transit radio. Incidentally, five states now have no FM broadcast stations: Montana, Nebraska, North Dakota, Vermont, and Wyoming. And no FM applications have ever been received from Montana, while the other four mentioned once upon a time had FM stations. The only FM station operating in any of our territories or island possessions is in Hawaii.

Interference is still classified as a balky problem, the annual report disclosed. Due to the mounting number of radio stations, the extreme sensitivity of TV reception, and the increased use of electronic equipment and electrical gadgets, the number of interference cases requiring field investigation exceeded 18,000.

Restricted radiation devices, such as community-antenna systems and radiating receivers, continued to be the basis of a number of complaints.

Commenting on typical complaints received, the Commission said that a single excessively-radiating FM receiver resulted in a series of phone calls and letters from over forty TV-receiver owners in Wardensville, W.Va. And a TV receiver booster in Beaumont, Texas, was found to be inter-

fering with an estimated 3000 TV receivers within the range of more than a mile. A defective amplifier associated with an apartment building master-TV antenna in Buffalo, N. Y., was found to be quite a culprit too; its interfering oscillations were stronger than the signal of the local TV station. As a result, complaining calls poured in, particularly to the telephone switchboard at the station, and also at a nearby hospital where viewers had mistakenly blamed equipment at the hospital for the trouble.

Citing examples of interference from restricted and incidental radiation devices, the report described an odd case reported by the Coast Guard; interference to a marine and distress frequency was traced to an electric fence on an inland farm. In Oklahoma, the public utilities ran into an unusual interference situation. A carrier-current telemetering circuit was found to be a radiator, and interfering with a carrier-current system operated by a telephone company. In Chicago, TV interference was traced to the complainant's own electronic garage door-opening device.

IN '54, 576 cases of interference were caused by industrial, scientific and medical equipment; a drop from the 641 received in '53, thanks, in part, to the new program of equipment control through certification and educational programs explaining how filters and shielding can be used to curb radiation. According to the Commission a number of cases of serious interference to military and other communication facilities in the New York area were traced to inadequately shielded industrial-heating equipment in plants manufacturing plastic products such as toys, raincoats, pocket-books, and so on.

Elsewhere, arc welders and electronic health machines were also found to be transmitters, causing trouble for a number of services including the aircraft. The arc-welder problem, the Commission said, is still far from solved. In these welders, radio-frequency energy is used to stabilize the arc when welding stainless steel or certain nonferrous metals, such as aluminum, in an inert gas atmosphere. The arc welders use spark-type oscillator; and, as a consequence, they produce a broad range of interference. The FCC has successively postponed

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Has your income been increasing each year? America's total bill for servicing has been going up fast. Can you look forward to a secure future? UHF, Color Television, other Electronic developments will pay off for men who keep up with the field.

for more knowledge to be able to forge ahead.

UHF and Color TV Making New Boom

Installing front-end channel selector strips in modern UHF-VHF Television receivers and learning UHF servicing problems and their solution is part of the practice you get if you live in a UHF area. To cash in on the coming color TV boom you'll need the experience this training gives.

The most foolproof, sure-fire way ever discovered for reaching greater success—*independence—security—is to keep on learning more!*

Not For Beginners

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Get Details FREE

Find out what you get, what you learn from NRI's new course in Professional Television Servicing. See pictures of equipment supplied, read what you practice. Judge for yourself whether this training will further your ambition to reach the top in TV servicing. Mailing the coupon involves no obligation. Address National Radio Institute, Dept. 5CET, 16 & U Sts., N.W., Washington 9, D.C.

Priced under \$200. Equipment supplied includes 17" Picture Tube, Components for TV Receiver, Scope, Signal Generator, HF Probe. LOW MONTHLY PAYMENTS

You learn by doing! This is 100% practical training. We supply all the components, all tubes, including a 17-inch picture tube, and comprehensive manuals covering a thoroughly planned program of practice. You see how various defects affect the performance of a TV receiver—learn to know the causes of defects, accurately, easily, and how to fix them. You do more than just build circuits. You get practice recognizing and fixing innumerable TV receiver troubles. You get actual experience aligning TV receivers, diagnosing the causes of complaints from scope patterns, eliminating interference, using germanium crystals to rectify the TV picture signal, and much more service experience too extensive to list.



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March, 1955

RADIO & TELEVISION NEWS

BE YOUR OWN AUDIO ENGINEER

MODEL 80
MODEL 8112
MODEL 8115

CABINART



Model 80 has lift lid, removable panels, Bass reflex tuned for 12" or 15" speakers. Overall dimensions: 33 1/2" H, 23" W, 16" D. M80 tuner section, inside: 20" H, 21 1/4" W, 15 1/2" D. M8112, M8115 baffle volume: 6 cubic feet. 3/4" white pine

80	equipment cabinet kit	\$37.00
8112	12" speaker cabinet kit	18.00
8115	15" speaker cabinet kit	18.00

K I T S

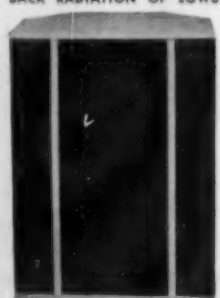
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FEATURING
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Rebel* 4 KITS



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ready-to-finish birch

MODEL K-12
MODEL K-15
K. 12 36.00
K. 15 42.00

All kits precision-cut to size, baffles pre-cut for 12" or 15" speakers. Kits include Saran plastic acoustical cloth, glue, sandpaper, plastic wood, hardware, assembly instructions and finishing instructions. Write for complete catalogs and nearest Cabinart kit dealer.

REBEL enclosure development entails a cavity and slot port, to form a resonant chamber, and a horn coupled to the slot. The slot is loaded by the horn; the proportioning of slot, cavity and horn provide bass response below 100 cycles which corresponds in efficiency to the front-of-cone direct radiator response above this critical 100-cycle point. There are two ways one might consider the function of this horn. One is a bass reflex with a horn acting as a resistive load on the port. System resonances are damped by useful radiation resistance while the horn does not cost anything. It is already formed by the room corner. Again, if a full horn were added below the 100-cycle point bass response would be boomy and unnatural. But, in the Rebel enclosures, the cavity-port combination acts as an acoustic low pass filter. And its design is such that low-end response will compare with response higher in the sound scale.

Model 61, Model 43
corner horn



12" speaker — \$19.95
15" speaker — \$23.95

all prices slightly higher west and south

* Trade Mark

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75 North 11th Street
Brooklyn, N. Y.

issuance of a ruling covering welding stabilizers, while working with industry to develop mutually satisfactory standards. The Navy has also been called in to lend a hand.

A new type of medical equipment, that could be a source of radiation, also came into the picture during the year; ultrasonic apparatus. As a result, the Commission was petitioned by the Electro Medical Manufacturers Association to provide for type approval and establish radiation limitations.

Reviewing the number of radio operator authorizations of different classes now outstanding, the annual survey declared that there are 850,000 commercial and 120,000 ham operators listed; figures that are strikingly illustrative of the tremendous growth of industry during the two decades that the Commission has been in business.

A REVEALING ANALYSIS of the progress made by radio and electronics in the railroad world appeared recently in a special report issued by the Washington office of the Association of American Railroads.

It is no exaggeration to say, it was noted, that radio and coordinated communications improvements have revolutionized important phases of yard operations. Explaining radio's role, the report said that in a large modern yard, the yardmaster now is in instant touch with all switching crews under his jurisdiction. By means of two-way radio, he can communicate instructions to or receive information from crews of switching engines at great distances from headquarters. Loudspeakers on the ground permit him to communicate with hump and tower operators, while talk-back speakers throughout the yard permit two-way conversations. Under present conditions requiring speedy classification and dispatch of the long trains now operated, the value of such instant communication and coordination is obvious, the rail-group survey reported.

Within the switching crew itself, a round-robin communication circuit is used in flat-switching yards, and a conductor carries a portable radio into which he speaks his orders, the report disclosed. Signals from this radio automatically actuate both a high-powered relay transmitter and a local loudspeaker system. The engineer thus receives the order by radio, at the same time the switchmen hear it over yard loudspeakers. The engineer, in turn, can reply over his radio transmitter, with his message heard by both the conductor and switchmen over the loudspeaker system.

Similarly, it was said, utilization of radio in train operation yields valuable benefits. With trains a mile or more in length not uncommon now, communication from front to rear by hand signals leaves much to be desired. Radio communication between caboose and engine meets this need, and brings many advantages in getting trains
(Continued on page 173)

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Almost immediately, you feel the benefits of CREI training. Your employer, when informed of your step toward advancement (only at your request), is certain to take new interest in you and in your future. What you learn in CREI Home Study can start helping you do a better job immediately.



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- ☐ TELEVISION
- ☐ MANUFACTURING
- ☐ COMMUNICATIONS
- ☐ SERVICING
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Then something happens. Things look up. You become more confident. Your earnings rise. You feel more important.

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"Contacts," others may suggest.

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Today there are over 97,000 radio-equipped police cars; an even larger number of taxis are radio equipped (at least 87,000); 32,000 civilian planes have radio; 35,000

American ships have radio.

Today there are over 120,000,000 radios in use. There are 28,000,000 TV sets and 381 TV stations in operation. Color TV is coming into its own. Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. To fill these posts, trained men are needed—men who somewhere along the line take time to improve their knowledge, their skills. Men who, today, perhaps, take two minutes to send for a booklet.

"Your Future in the New World of Electronics" shows you how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

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Washington 10, D. C.

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Save time and money, with this complete lab of 20 2 oz. G-C chemicals. Do all repairs to speakers, coils, dials, etc. Free metal rack included.
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NET \$7.65



G-C ROOF-SEAL COMPOUND
Seal holes in roofs on roof-top antenna installations. Stop call-backs.
NO. 10-16 Pint can

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G-C LENS-TUBE CLEANER
Specially prepared to remove finger marks and spots on picture tube and lens.
NO. 210-2-2-oz. bottle

NET \$9.30



G-C DE-OX-10
Cleans and prevents oxidation on all sensitive circuit contacts, switches, etc.
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NET \$9.16



G-C INSULATION AND DIPPING VARNISH
Treat field coils, chokes, noisy or buzzing transformers.
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G-C SCRATCH REMOVER
Dark shade covers hairline scratches, renews appearance of TV set, furniture.
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G-C DELUXE FELT-KOAT KIT
Complete flock finishing kit for applying to turntables, grilles, cabinets, etc.
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G-C DIAL CORD DRESSING
Prevents dial cord slipping. Simply rub dressing stock on cord. Long lasting.
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G-C RADIO KNOB KIT
Kit contains 35 assorted walnut and ivory replacement knobs. Includes springs.
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NET \$2.82



G-C KNOB SPRING KIT
Kit of 100 knob springs in 12 different styles. Tempered spring steel.
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G-C TURNTABLE SPRING KIT
Kit of 50 assorted turntable springs for replacement on RCA, Philco, Zenith, etc.
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NET \$1.65



G-C WOOD CABINET GLUE
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NO. 39-2 2-oz. bottle

NET \$8.30



CEMENT

Ask For These
RADIO-TV SERVICE AIDS

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G-C RADIO-TV SPAGHETTI
Best grade varnished tubing in 20-ft. lengths. Fit No. 12. No. 10 wire. Five colors.
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NET \$1.11



G-C MIKE CONNECTOR
Single contact male type, completely shielded. Brass, bright chrome plated.
NO. 7940

NET \$0.30



G-C PHONO PLUG
Phono connector for RCA, Philco, Zenith and others. Use also for auto radio.
NO. 1742

NET \$0.86



G-C STD. TERMINAL STRIPS
Bakelite insulation $\frac{1}{4}$ " thick, $\frac{1}{2}$ " spacing. Five lugs, others 1 to 12.
NO. 1785

NET \$0.972



G-C POCKET WIRE STRIPPER
Popular wire stripper is also scraper, cutter, screwdriver and wire winder.
NO. 757

NET \$0.30



G-C STATIC SPRING
Eliminates auto front wheel static noise. Riveted metal points for firm contact.
NO. 1059

NET \$0.85



G-C AUTO RADIO TUNER
Handy tuner tool for adjusting auto radio when chassis and cables are removed.
NO. 8285

NET \$0.72



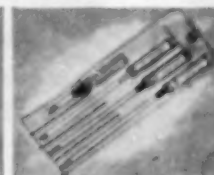
G-C FAHNESTOCK CLIPS
Spring brass, $\frac{1}{8}$ " long x $\frac{1}{16}$ " wide. No. 6 mtg. hole. Box of 144. Medium Size.
NO. 6302-G

NET \$2.46



G-C BANANA JACK
Standard jack, insulated $\frac{1}{16}$ " head. Mounts in $\frac{1}{16}$ " hole.
NO. 7741 Color Red

NET \$0.132



G-C TV ALIGNMENT KIT
Handy versatile alignment tool kit in plastic holder. Four basic tools.
NO. 8457

NET \$1.77



G-C HANDLE INSULATORS
Envelope of assorted sizes to insulate handles on pliers, cutters, etc. Heat appearing.
NO. 8110-E

NET \$0.27



G-C 6-PIECE "SLIP-ON" SET
Friction handle holds 5 plated hex sockets. Sizes: $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ".
NO. 715

NET \$1.35



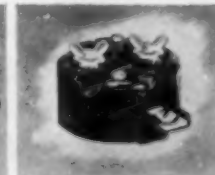
G-C INSPECTION LIGHT
Service light where you want it. Ideal for production inspection, 110 v. AC-DC.
NO. 705

NET \$1.35



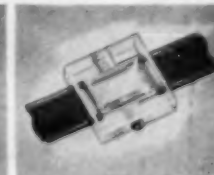
G-C PIN STRAIGHTENER
Straightens both miniature and jumbo-miniature tubes of both 7- and 9-pin types.
NO. 8055

NET \$1.50



G-C LIGHTNING ARRESTOR
Underwriters' approved, for all types of UHF-VHF lead-in lines. Easy to use.
NO. 8642

NET \$0.75



G-C 300-OHM CONNECTOR
Screw-type connector to splice 300-ohm twin line. Retains wire characteristics.
NO. 8095-E Env. of 2

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G-C H. O. POWER SWITCH
D.P.S.T. toggle switch. Rated 12 amp. at 125 volts. For motors, appliances, etc.
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NO. 9015

NET \$0.72



G-C UHF-VHF LIGHTNING ARRESTOR
NO. 8642

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"MITTY-V" ADJUSTABLE UHF-VHF ANTENNA
NO. A-5008

NET \$2.25

model no. 330-2
332-2

a major step forward
in installation procedures —

**CHANNEL
MASTER'S**

SELECTENNA

coupling system

the great Channel Master development
that permits *unlimited antenna combinations*
with only one transmission line to the set!

the **NEW WAY**, the **BEST WAY**,
the only **AUTOMATIC WAY** to get
all-channel, all-direction reception . . .

• **Without rotators!**

Selectenna means: no extra control unit on the set; no moving parts to get out of order; antennas are always in perfect orientation.

• **Without switches!**

Selectenna means: no manual switches to bother with; better performance because couplers have less insertion loss than switches.

• **Without multiple lead-in wires!**

Selectenna means: neater, more professional installations, because no complicated wiring enters the home. Only one lead connects to the set.

This modern way to obtain multi-directional reception — with its individual band-pass filter networks — offers the consumer great convenience advantages possible in no other system. There's never been anything like it! The Selectenna System is rapidly replacing all older methods. Use it on your next "multi-direction" installation!

**FREE TECHNICAL
ADVISORY SERVICE**

Our engineers will tell you the correct hook-up for your area. Merely list the channels you expect to receive, as well as the different antennas you would like to hook up. No charge or obligation.



Simple as:



Simply select your
channel on the set---
the right signal is
always there!

list price:
\$542
each

including mounting
hardware and
connecting wire.

Couplers snap together. This particular interlocked stack consists of four Antenna Couplers and one Hi-Lo Coupler, for joining two High Band and two Low Band antennas.



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ELLENVILLE, N. Y.
The World's Largest Manufacturer of Television Antennas and Accessories.

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TRAVELING LIGHT

BUT WITH A COMPLETE

pocket-sized

LABORATORY

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ON HAND for his service needs in the Triplet

Model 666R pocket size VOM

TRAVELING LIGHT, too, on expense

Model 666R is only \$26.50 dealer net

*All Triplet test instruments
meet the requirements of tomor-
row's color TV!*

Enclosed selector switch of molded construction keeps dirt out. Retains contact alignment permanently. A Triplet design representing the culmination of a quarter-century of switch making experience. Unit construction—All resistors, shunts, rectifier and batteries housed in a molded base integral with the switch. Eliminates chance for shorts. Direct connections. No cabling.

Precision film or wire-wound resistors, mounted in their own separate compartment—assures greater accuracy. Four connectors at top of case, controls, knobs and instrument are all flush mounted with the panel.

3" 0-200 Microammeter, RED • DOT Lifetime guaranteed. Red and black dial markings on white. Easy to read scale.

Precalibrated rectifier unit. Batteries—self-contained, snap-in types, easily replaced.

RANGES

D.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt.

A.C. VOLTS: 0-10-50-250-1000-5000, at 1000 Ohms/Volt.

D.C. MA: 0-10-100, at 250 M.V.

D.C. AMP.: 0-1, at 250 M.V.

OHMS: 0-3000-300,000 (20-2000 center scale).

MEGOHMS: 0-3 (20,000 Ohms center scale).

(Compensated Ohmmeter circuit.)

Also available—Model 666-HH Pocket VOM, Dealer Net \$24.50.

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TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio



Dim.: 3 1/16 x 5 7/8 x 2 9/16

RADIO & TELEVISION NEWS



L. C. Lane, B.S., M.A.
President, Radio-Television
Training Association.
Executive Director, Pierce
School of Radio & Television.

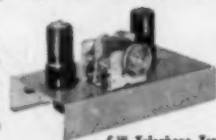
Study AT HOME in your SPARE TIME
to be a TELEVISION TECHNICIAN

VETERANS!
NON-VETERANS!

**YOU LEARN MORE
because I GIVE YOU MORE!**



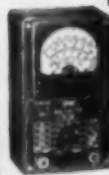
Super-Het
Radio Receiver



C-W Telephone Transmitter



Public Address System



Combination Voltmeter-
Ammeter-Ohmmeter



RF Signal
Generator

LEARN BY DOING

Every one of my students gets enough equipment to set up his own home laboratory. You learn to be a television technician by actually doing what a TV technician must do on the job. With the equipment I send you, you build and keep a professional GIANT SCREEN TV RECEIVER complete with big picture tube (takes any size up to 21-inch) . . . also a Super-Het Radio Receiver, AF-RF Signal Generator, Combination Voltmeter-Ammeter-Ohmmeter, C-W Telephone Transmitter, Public Address System, AC-DC Power Supply. Everything supplied, including all tubes. No experience is necessary . . . My practical, easy-to-understand lessons have brought success to hundreds of men, many with no more than a grammar school education.

CHOOSE FROM 3 COMPLETE COURSES

My Courses cover all phases of radio, FM and television.

1 Radio, FM and Television Technician Course (No Previous Experience Necessary)

You learn by practicing with the professional equipment I send you. Many of my graduates now hold down good paying technician jobs with such firms as RCA, NBC-TV, CBS-TV, DUMONT TV and numerous other TV studios and plants.

2 FM-TV Technician Course (Previous Training or Experience in Radio Required)

You can save months of time if you have previous Armed Forces or civilian radio experience! Train at home with kits of parts, plus equipment to build BIG SCREEN TV RECEIVER. ALL FURNISHED AT NO EXTRA COST!

EXTRA TRAINING IN NEW YORK CITY AT NO EXTRA COST!

After you finish your home study training in Course 1 or 2 you get two weeks, 50 hours, of intensive Laboratory work on modern electronic equipment at our associate school in New York City, Pierce School of Radio & Television. THIS EXTRA TRAINING IS YOURS AT NO EXTRA COST WHATSOEVER. My courses are complete without this extra training, however. It is just an added opportunity for review and practice.

3 TV Cameraman and Studio Technician Course (Advanced Training for Men with Radio or TV Training or Experience)

I train you at home for an exciting high pay job as the man behind the TV camera. Work with TV stars in TV studios or "on location" at remote pick-ups! An optional 30 hour one-week course of practical work on TV studio equipment at Pierce School is offered upon completion of Course 3.

Radio Television Training Association

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March, 1955

EARN WHILE YOU LEARN

Almost from the very start you can earn extra money while learning by repairing Radio-TV sets for friends and neighbors. Many of my students earn up to \$25 a week . . . pay for their entire training from spare time earnings. . . start their own profitable service business.

FREE FCC COACHING COURSE!

Important for BETTER PAY JOBS requiring FCC License. You get this training AT NO EXTRA COST. Top TV jobs go to FCC-licensed technicians.

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My School fully approved to train veterans under new Korean G.I. Bill. Write discharge date on coupon.

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ALL FOUR FREE**

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NO SALESMAN WILL CALL!



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RADIO-TELEVISION TRAINING ASSOCIATION
52 East 19th Street, New York 3, N. Y.

Dept. T3

Dear Mr. Lane: Mail me your NEW FREE BOOK, FREE SAMPLE LESSON, and FREE aids that will show me how I can make BIG MONEY IN TELEVISION. I understand I am under no obligation and no salesman will call.

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I AM INTERESTED IN:

☐ Radio-FM-TV Technician Course
☐ FM-TV Technician Course
☐ TV Cameraman & Studio Technician Course

VETERANS!

Write discharge date

Your best buy!

...for new installations

...for replacement needs!

...the fastest mounting, best performing aerial on the market

RADIART
Speed-Dee
AUTO AERIAL
MODEL 8BE

Here is the outstanding, NEW auto aerial and it has everything! Handsome in appearance ... outstanding in performance ... and a new design that is a snappy one-two-three installation WITHOUT EVEN LOOKING UNDER THE FENDER!

Here are a few of the features:

- ★ Speedy, one-man installation
- ★ 30" mast adjustment
- ★ Fits all body and fender contours
- ★ 57½" length extended - 18-8 stainless steel
- ★ Extra long, full 42" polyethylene lead-in

FEATURING EASY 1-2-3 INSTALLATION

SUBSIDIARY OF



THE RADIART CORPORATION
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TV Antennas - Auto Aerials - Vibrators - Rotors - Power Supplies

RADIO & TELEVISION NEWS

Home Study Courses in TELEVISION SERVICING offered by RCA INSTITUTES



Study Television Servicing—from the very source of the latest, up-to-the-minute TV and Color TV developments. Train under the direction of men who are experts in this field. Take advantage of this opportunity to place yourself on the road to success in television. RCA Institutes, Inc. (A Service of Radio Corporation of America), thoroughly trains you in the "why" as well as the "how" of servicing television receivers.

FIRST HOME STUDY COURSE IN COLOR TV SERVICING

Now you can train yourself to take advantage of the big future in Color TV. RCA Institutes Home Study Course covers all phases of Color TV Servicing. It is a practical down-to-earth course in basic color theory as well as how-to-do-it servicing techniques.

This color television course was planned and developed through the combined efforts of instructors of RCA Institutes, engineers of RCA Laboratories, and training specialists of RCA Service Company. You get the benefit of years of RCA research and development in color television.

Because of its highly specialized nature, this course is offered only to those already experienced in radio-television servicing. Color TV Servicing will open the door to the big opportunity you've always hoped for. Find out how easy it is to cash in on color TV. *Mail coupon today.*

SEND FOR FREE BOOKLET

Mail coupon in envelope or paste on postal card. Check course you are interested in. We will send you a booklet that gives you complete information. No salesman will call.



RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION OF AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.



HOME STUDY COURSE IN BLACK-AND-WHITE TV SERVICING

Thousands of men in the radio-electronics industry have successfully trained themselves as qualified specialists for a good job or a business of their own—servicing television receivers. You can do this too.

This RCA Institutes TV Servicing course gives you up-to-the-minute training and information on the very latest developments in black-and-white television.

As you study at home, in your spare time, you progress rapidly. Hundreds of pictures and diagrams, easy-to-understand lessons help you to quickly become a qualified TV serviceman.

There are ample opportunities in TV, for radio servicemen who have expert training. Mail coupon today. Start on the road to success in TV Servicing.

MAIL COUPON NOW

RCA INSTITUTES, INC.
Home Study Dept. RN 355
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet on:

- ☐ Home Study Course in TELEVISION SERVICING.
☐ Home Study Course in COLOR TV SERVICING.

Name _____ (please print)

Address _____

City _____ Zone _____ State _____

FOR A LIMITED TIME
to introduce
the first NEW design of selenium rectifiers

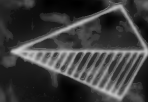
in OVER 20 YEARS



Service equipment will be better than new when you replace with a Koolseal rectifier by Pyramid.

- No center mounting
- Full air ventilation between plates
- Light contact and constant assembly pressure
- No center hot spots
- Lightest weight per unit of output power
- Lower initial forward resistance—better voltage regulation
- Smaller overall size for each rating—cost no more
- Better for all electrical and electronic equipment because of
- Improved convection cooling
- Simpler mounting
- Longer life and minimum aging
- Designed for more rugged service and rated for use in high ambient temperatures

In stock at your Pyramid jobber now.



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National Schools brings you a new dimension in training for TELEVISION-RADIO-ELECTRONICS

YOU CAN LEARN BY HOME STUDY, IF—

- you are ambitious to increase your earning power.
- you want to broaden your knowledge and skill.
- you choose the school with the most complete training and service.

50 Years of Successful Training

National Schools has been training men for success since 1905. Our graduates are located around the globe, in good-paying jobs in servicing, installation and manufacturing... in public and private industry, or in their own businesses. All this experience and background are your assurance of success.

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As a National Schools student, with Shop Method Home Training, you master all phases of the industry—TV, Radio, Electronics—theory and practice. You learn HOW and WHY, in one complete course at one low tuition.

Because National Schools' world headquarters are in Los Angeles—"capital city" of TV-Radio-Electronics—our staff is in close touch with industry. Our lessons and manuals are constantly revised to keep you up-to-the-minute on latest developments. We show you how to make spare time earnings as you learn, and we give you free placement assistance upon graduation. National Schools is approved for G. I. Training. Both Resident and Home Study courses are offered. If you are of draft age, our training helps you achieve specialized ratings and higher pay grades. This new dimension enables us to train you as you should be trained at home, regardless of your age or previous education.

Your Course Includes Valuable Units

We send you important equipment, including a commercial, pro-

fessional Multitester... plus parts to build Receivers, Oscillators, Signal Generator, Continuity Checker, other units, and Short Wave and Standard Broadcast Superhet Receiver.

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Rush FREE BOOK, "Your Future in Radio-TV-Electronics," and FREE LESSON. No obligation, no salesman will call.

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ADDRESS _____

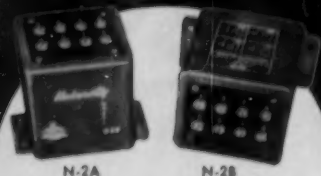
CITY _____ ZONE _____ STATE _____

☐ Check if interested ONLY in Resident Training at Los Angeles, VETERANS: Give date of discharge _____

now... Adjustable Speaker Networks by *University*

- To balance your system
- To suit any speaker combination
- To improve your present system

For the first time, networks and filters, so designed as to provide a wide selection of popular crossovers at various speaker impedances—so engineered as to expand, without waste or obsolescence, the sound reproduction of 2-way and 3-way systems. The built-in versatility of these units allows you to assemble systems that suit your own taste, operating conditions, and budget.



ADJUSTABLE L/C DIVIDING NETWORKS As 2-way networks:

MODEL N-2A		MODEL N-2B	
Impedance	Crossover Selections	Impedance	Crossover Selections
8 Ohms	350, 700	8 Ohms	1250, 2500, 5000
16 Ohms	350, 700	16 Ohms	2500, 5000
4 Ohms	700	4 Ohms	2500, 5000

These units can be used singly as 6db/oct 2-way L/C networks, singly as 12db/oct L/C filters, in pairs as 12db/oct 2-way networks and in combination as 3-way networks.

MODEL N-1 ADJUSTABLE HIGH PASS FILTER

Built-in continuously variable high frequency control. Matches 16 ohms to 1250, 2500, 5000 cycle crossover. 8 ohms to 2500, 5000, 10,000 cycles; 4 ohms to 5000 and 10,000 cycles.



MODEL N-3 THREE-WAY CROSSOVER NETWORK

Complete with built-in continuously variable "presence" and "brilliance" controls. For 8 ohm 3-way systems using 350 and 5000 cps crossovers. Adjustable mounting arrangements.



For descriptive literature write desk 57

Another engineering achievement of

University
LOUDSPEAKERS, INC.

85 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

Ask For Progressive Speaker Expansion

Within the INDUSTRY

RAYMOND W. DURST, executive vice-president of *Hallcrafters Company*, has been elected president of the firm while **William J. Halligan**, president, has been named to the newly-created post of chairman of the board.

The new president joined the radio and television manufacturing company in 1936 as executive vice-president. Prior to that, from 1930 to 1936, he was first comptroller and later secretary-treasurer and a director of the *Echophone Radio Corporation* of Chicago.



THE INSTITUTE OF HIGH FIDELITY MANUFACTURERS has been chartered by New York State as a non-profit membership corporation.

The idea for the organization originated with the Audio Activities Committee of the Sales Managers' Club (Eastern Division). Working closely with official representatives of EP & EM and WCMA, the green light came at the joint meeting of the three audio groups during the New York Audio Fair.

The Institute is to be initially capitalized by manufacturers who are being invited to join the group as "charter members." In return for their dues, charter members will enjoy a number of privileges at forthcoming Audio Shows sponsored by the Institute plus preferred status at other shows.

Representatives from the following audio manufacturers are serving on the membership subcommittee: *Rek-O-Kut*, *United Transformer*, *Fisher Radio*, *Federal Manufacturing & Engineering*, *Gray Research*, *Reeves Soundcraft*, *Mark Simpson*, *University*, *Tech-Master*, *River Edge*, *Pilot*, *Rockbar*, *David Bogen*, *Harman-Kardon*, *Technical Tape*, *Telectrosonic*, *Freed Electronics*, and *British Industries Corporation*.

EDWARD W. BUTLER has been named vice-president in charge of sales for *Speer Carbon Co.* of St. Marys, Pa.

In his new post Mr. Butler will direct the sales of the company's diversified line of carbon and graphite products for electrical and automotive applications, etc. In joining the company, he leaves *International Telephone and Telegraph Co.* where he had been vice-president, *Federal Electric Co.*, and



sales manager of the Components Division of *Federal Telephone and Radio Co.*

Until recently, Mr. Butler was managing director of *Federal Electric Manufacturing Co., Ltd.*, Canadian affiliate of IT&T.

RETMA has organized an industrial relations department which will be headed by **Robert C. Sprague, Jr.** of *Sprague Electric Co.*

Establishment of the department was authorized in 1954 by the board of directors of the association. Its membership will consider, advise, and represent the association and its members concerning all industry-wide industrial, employee, and community relations problems. The scope of the new department also includes all associated legislative matters, economic education, and training programs as well as survey work.

WILLIAM H. KELLEY has been elected vice-president and general manager of all manufacturing and sales divisions of *Allen B. Du Mont Laboratories, Inc.*

The company's instrument, cathode-ray tube, communication products, international, government contracts, and receiver manufacturing and sales divisions will report to Mr. Kelley.

He was formerly associated with *Radio Corporation of America*, was vice-president in charge of sales for *Motorola*, and after serving that company for ten years, joined *Du Mont* as vice-president in charge of marketing.



SHURE BROTHERS, INC. will construct a new building in Evanston, Illinois which will house the company's entire operation. The new 80,000 square foot structure is expected to be ready for occupancy early in 1956.

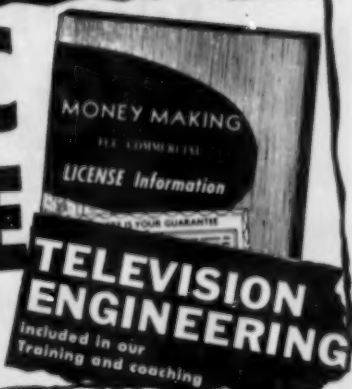
POLARAD ELECTRONICS CORPORATION has acquired 55,000 square feet of additional manufacturing space in a new plant located at 43-20 34th Street, Long Island City, N. Y. It will supplement the company's existing manufacturing facilities in Brooklyn. **EMERSON-NORTH YORK** has moved to larger headquarters in the Emerson Building, 524 W. 23rd Street, New York. **MOTOROLA'S** Communications and Electronics Division has established its fourth laboratory on a 14-acre tract at Indiana Avenue and Adams Street in Riverside, California. **NORTHWEST RADIO & TELEVISION SCHOOL** has established a Chicago branch at 540 N. Mich-



Carl E. Smith, E. E.
President

Want To DOUBLE YOUR PAY?

How To Pass FCC COMMERCIAL RADIO OPERATOR LICENSE EXAMINATIONS



GET THIS AMAZING NEW BOOKLET FREE!

TELLS HOW...

WE GUARANTEE

TO TRAIN AND COACH YOU AT
HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting.

HERE IS YOUR GUARANTEE

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial License, provided you first sit for this examination within 90 days after completing your course.

An Approved Member



TELLS HOW...

Our Amazingly Effective JOB-FINDING SERVICE

Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license, and am now employed by Civil Service at Great Lakes Naval Training Station as an Equipment Specialist." Kenneth R. Lester, Fair Oaks, Md. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky State Police."

Edwin P. Healy, 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

"I wish to thank your Job-Finding Service for the help in securing for me the position of transmitter operator here at WCAR in Pittsburgh." Walter Koscik, 1442 Ridge Ave., N. Braddock, Pa.

GETS AIRLINES JOB

"Due to your Job-Finding Service, I have been getting many offers from all over the country, and I have taken a job with Capital Airlines in Chicago, as a Radio Mechanic." Harry Clare, 4527 N. Drexel Blvd., Chicago, Ill.

TELLS HOW...

Employers Make JOB OFFERS Like These to Our Graduates Every Month!

Letter from nationally-known Airlines:

"Radio Operators and Radio Mechanics are needed for our company. Periodic wage increase with opportunity for advancement. Both positions include many company benefits such as paid vacations, free flight mileage allowance and group insurance."

Letter from nationally-known manufacturer:

"We have a very great need at the present time for radio-electronics technicians and would appreciate any helpful suggestions that you may be able to offer."

These are just a few examples of the job offers that come to our office periodically. Some licensed radiomen filled each of these jobs... it might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING AT HOME IN SPARE TIME

Name and Address	License	Time
Harry G. Frame, Box 429, Charlestown, W. Va.	2nd Class	13 Weeks
Charles Ellis, Box 449, Charles City, Iowa	1st Class	28 Weeks
Omar Bibbs, 1320 E. 27th St., Kansas City, Mo.	1st Class	34 Weeks
Kenneth Rue, Dresser, Wisconsin	2nd Class	20 Weeks
B. L. Jordan, Seattle, Washington	1st Class	20 Weeks

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Carl E. Smith, E. E., Consulting Engineer, President
Desk RH-74, 4900 Euclid Bldg., Cleveland 3, Ohio

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STUDY COURSE
WHICH SUP-
PLIES FCC-TYPE
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WITH ALL LES-
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Your FCC Ticket is recognized by most employers in the electronic field as proof of your technical ability.

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I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exam for Amateur License), or send me a sample FCC-type exam and the amazing new booklet, "Memory-Making FCC License Information."

Be Sure to tell me about your television engineering course.

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Special tuition rates to members of the U.S. Armed Forces.
For prompt results, send our money.

craftsmen GOES DIRECT!

Bringing these Savings to You . . .

Effective March 1, Radio Craftsmen will begin a new policy—
"Selling directly to you."

The same fine Craftsmen Components that have previously been sold only through High Fidelity Dealers and Radio Parts Distributors can now be purchased direct from the factory—at tremendous savings. This new sales policy is designed to offer you the finest High Fidelity Equipment at the lowest possible price.



CRAFTSMEN *Solitaire*

Here is the finest, most flexible unit offered by any manufacturer. All you need for a professional home music system is the Solitaire, a fine record player and speaker. This exceptional new unit contains a full 20 watt power amplifier, a preamplifier and an exclusive sharp cut-off filter, housed in an attractive cabinet of leather etched steel. Inputs for magnetic phono cartridge, FM-AM tuner, tape recorder and TV receiver. Six record equalization positions. Contour type loudness control, and separate bass and treble tone controls giving 15 db boost and 13 db attenuation. Sharp cut-off filter system removes both high and low frequency noises. Basic amplifier is based on Williamson Ultra-linear design. Frequency response: ± 0.5 db, 20-20,000 cycles. IM distortion less than 2% at 20 watts. Size: 4 x $14\frac{1}{2}$ x $11\frac{1}{2}$ ". Weight 25 lbs.
Price was \$113.50 **NOW ONLY \$86.50**

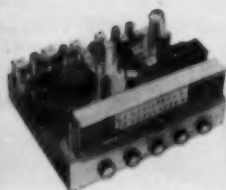
C10 FM-AM Tuner

There are more C10 tuners now in use than any other FM-AM tuners ever made. The proof of its exceptional performance and durability is in the thousands of installations in homes, leading radio and TV stations, schools and hospitals. Has independent, continuously variable tone controls, built-in preamplifier, and two cathode follower outputs. Frequency Response: 20 to 20,000 cps. Sensitivity less than 5 microvolts. AFC for simplified, "no-drift" tuning. 12 tubes including rectifier. Weight—17 lbs.
Was \$131.50 **NOW ONLY \$107.50**



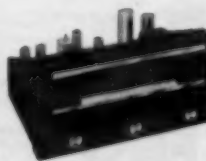
C1000 FM-AM Tuner

For more than just a tuner, the C1000 is a complete control center for your Hi-Fi system. Here is a superior FM-AM tuner, a complete preamplifier with 4 positions of record equalization and input circuits for TV, tape recorder and phono. Has two AM bandwidths; broad for local Hi-Fi and sharp for distant or noisy stations. FM sensitivity: 2 mv for 30 db quieting. AFC and 2 cathode follower outputs. Wt. 25 lbs.
Was \$179.50 **NOW ONLY \$161.00**



C900 Basic FM Tuner

For use with Solitaire or C350 Preamplifier. Designed for broadcast monitoring where low distortion, ultimate stability, and high sensitivity are needed. Exclusive printed IF coils (20.6 mc); variable amplified AFC and lower over-all distortion than any station. Frequency response $\pm 1\frac{1}{2}$ db 20-20,000 cycles. Overall IM distortion for 100% modulation less than .05%. Sensitivity, 2 microvolts for 30 db quieting.
Weight 17 lbs.
Was \$119.50 **NOW ONLY \$99.50**



C810 Basic FM-AM Tuner

For use with the Solitaire or C350 preamplifier. Does not have built in preamplifier or tone controls. Exceptional FM sensitivity (4 mv. for 30 db of quieting) and wide band AM for true high fidelity performance. Frequency response ± 1 db 20-20,000 cps. Weight 21 lbs.
Price was \$134.50 **NOW ONLY \$97.50**

C550 30 Watt Amplifier

Here is maximum ruggedness, dependability and flawless reproduction at any volume level. Thirty full watts of audio power with only 0.1% harmonic and 0.5% IM distortion. Frequency response is far beyond the audible range (± 1 db 10-100,000 cps.) Special thermal time delay protects circuit. KT66 output tubes used exclusively for maximum efficiency. Wt. 33 lbs.
Was \$109.50 **NOW ONLY \$89.50**



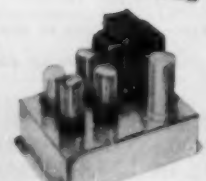
C400 Audio Amplifier

Exceptional performance at low cost. Streamlined narrow chassis for ease of installation. Push-pull 6V6 beam-tetrode tubes plus 13.5 db negative feed back provide 10 watts output with frequency response of 15 to 20,000 cps. (± 1 db). Harmonic distortion less than 1%; hum and noise level 70 db below rated output. Five tubes including rectifier. Weight 13 lbs.
Was \$43.90 **NOW ONLY \$29.50**



C450 Audio Amplifier

Ideal for budget Hi-Fi systems. Has same high quality craftsmanship as other Craftsmen amplifiers but with lower output of 6 watts. Frequency response: 20 to 20,000 cps. (± 1 db) with only one percent harmonic distortion. Push-pull 6W6GT beam-tetrode output tubes. Only 6 x $8\frac{1}{2}$ x 6 inches. Weight 10 lbs.
Was \$29.50 **NOW ONLY \$19.50**



Order direct from factory and save. Only by selling direct can Craftsmen offer you these exceptional units at so low a price. Don't delay—Order by Mail Today.

The Radio Craftsmen Inc. Dept. R3 4403 N. Ravenswood Ave. Chicago 40, Illinois

igan Ave. Other units of the school are located in Portland, Oregon and Hollywood, California. The Chicago unit will be a resident training school . . . The Houston sales office of **FEDERAL PACIFIC ELECTRIC COMPANY** has moved to Room 202 of the Bermac Building, Houston, Tex. . . . **THE BRISTOL COMPANY** has recently completed an expansion of its manufacturing plant and its office facilities in Waterbury, Conn. . . . **RICHARD D. BREW AND COMPANY, INC.** has moved to a new, ultra-modern plant in Concord, N. H. The firm was formerly located in Belmont, Mass. . . . **ROBERTSHAW-FULTON CONTROLS COMPANY** has opened new and larger facilities at 8406 W. McNichols Road in Detroit. The office was formerly located at 2680 W. Grand Boulevard . . . **ARROW SALES, INC.** has opened a branch sales office at 2441 S. Michigan Ave. in Chicago and a branch sales-showroom at 2005 Empire Ave. in Burbank, Cal. The new facilities are in addition to the company's main office at 7460 Varna Ave., North Hollywood, California.

CLIFF KNOBLE has been named merchandising manager of the television and radio operations of the *Raytheon Manufacturing Company*.



He was formerly advertising manager for the operations and prior to that was advertising manager for nine years for the *Chrysler Corporation* in Detroit. He was formerly an advertising agency account executive for *Ruthrauff and Ryan* in Chicago where he was responsible for the advertising of such products as the *Bendix* home laundry and *American Kitchens*.

He will make his headquarters at the Chicago plant of the firm.

PRINTED CIRCUITS, INC. has been established at 36 Tunxis Ave., Bloomfield, Conn., for the design, engineering, and manufacture of all types of printed circuit boards . . . **AUDIO MARKETING SERVICES** has been formed in Los Angeles to handle high-fidelity components in Southern California, Arizona, and Nevada. The showroom and offices are at 860 N. Vine Street . . . Formation of a new electronics engineering and manufacturing organization, **RANSOM RESEARCH**, has been announced by David H. Ransom, founder. The company's mail address is P.O. Box 382, San Pedro, California. The firm is presently in production on electronic decade counters and electronic voltage regulators. Other products will be added later . . . **HOFFMAN RADIO CORP.** has changed its name to **HOFFMAN ELECTRONIC CORP.** to more adequately reflect the diversified nature of the firm's manufacturing operations . . . **LOUIS A. GARTEN & ASSOCIATES** has been organized as a manufacturers' representative firm with headquarters

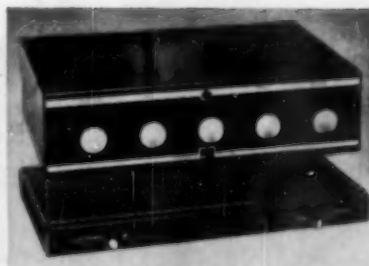
(Continued on page 102)

BUY DIRECT and SAVE!

Order by mail direct from factory, the finest equipment in high fidelity.

The best known name in high fidelity

craftsmen



C350 Equalizer Preamplifier

New audio control system designed for exceptional flexibility and low distortion. Has exclusive "Hinged tone control circuit"—eliminates boom and rasp typical of conventional tone controls. Seven accurate record equalization positions. New British 2729 preamplifier tube results in a new low in noise, hum and distortion. New compensated Loudness Control reinforces highs and lows at soft volume settings. Has 4 input circuits for FM-AM tuner, TV, tape recorder and magnetic cartridge. Two cathode follower outputs for amplifier and recording systems. All-triode circuitry reduces distortion to vanishing point. Wt. 11 lbs. Was \$129.50 NOW ONLY \$89.50

C375 Sharp Cut-Off Filter System

Eliminates distortion present at the extremes of frequency range, invaluable in obtaining maximum enjoyment from records, tape or FM broadcasts. Low frequency cut-off points: Flat, 40, 70, 120 and 200 cycles, reducing hum or turntable rumble. High frequency cut-off points: Flat, 9KC, 6KC, 4KC and 2.8KC. In flat position frequency response is ± 0.5 db, 20-20,000 cycles. Weight 8 lbs. Was \$39.50 NOW ONLY \$33.50

Save by mail. Order today direct from Craftsman.

Now you can have the finest High Fidelity equipment made . . . at the lowest prices ever offered.

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Quantity	Model No.	Item	Price

☐ Check or M.O. enclosed
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Orders from Canada and APO's must include full remittance.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

All Orders F.O.B. Chicago

"Everywhere! Even in the most extreme fringe areas, the sensational Winegard Interceptors are providing clear, enjoyable TV pictures."

Wilmington, Del.
 "First shipment of Interceptors and Pixies enthusiastically acclaimed by our dealers. Advertising claims well founded. Pixie will outperform a stacked conical . . . oftentimes at a much lower height. Interceptor better than anything we have run up against including large colinear arrays."
DELAWARE ELECTRONICS SUPPLY CO.

Reports like these from across the nation are pouring in, testifying to the exceptional performance of our antennas

WINEGARD INTERCEPTOR

A great new antenna that gives you both

1. Complete all-channel VHF coverage—
2. Brilliant yagi performance—
 Yes, the extraordinary high gain of a yagi . . .
 The pin-point directivity of a yagi . . .
 Not on just one channel—not on just one band—but clear across the whole VHF spectrum.

The Interceptor is designed for both black and white and color

The same Interceptor that gives you those sharp, clear black and white pictures today will give you the truest, brightest color pictures imaginable in the future.

NOTE—The Interceptor has been received so enthusiastically . . . all over the country . . . that the Winegard Company, even with around the clock production in its brand new plant, can't seem to make Interceptors fast enough. Twice this season production has been actually doubled over what was originally planned, and still we are experiencing difficulty in keeping up with this tremendous demand. So, get your order in now—and avoid disappointment on delivery.

List price U.S.A. . . . Interceptor . . . per bay . . . **\$24⁹⁵**
 (Stacking bars available)



IMP—Model L-7 for channels 7-13. On the high VHF band, the IMP functions as two high gain yagi—operating side by side in perfect phase, to give gain and directivity far in excess of more conventional 7-13 broad band designs.

Imp Features:

- Exceptionally high gain on channels 7-13.
- Full wave driven elements.
- Full wave reflector elements.
- Electro-Lens Focusing.*

Note—the IMP makes the perfect all-channel attic antenna for all channels in primary areas.

List price U.S.A. . . . Imp . . . per bay . . . **\$12⁹⁵**
 (Stacking bars available)

*PATENT PENDING

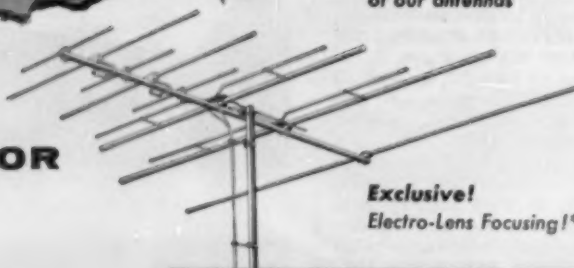
See your jobber or write us for additional information about the Interceptor and other Winegard antennas



WINEGARD COMPANY

3000 SCOTTEN BOULEVARD, BURLINGTON, IOWA

Winegard—America's most wanted line of TV antennas—designed to make installations quicker—easier—and more profitable



Exclusive!
 Electro-Lens Focusing!*

AND NOW up to 22% more gain! Super 'Ceptor
 (Super Interceptor)

A NEW more powerful version of our famous Winegard Interceptor—Now—makes it possible to have multi-element yagi performance on all channels in the most extreme fringe areas.

The Super 'Ceptor possesses all of the wonderful features of the Interceptor, but with much increased sensitivity . . . **up to 22% more gain** over the standard Interceptor model.

Features of the Interceptor and Super 'Ceptor

- Excellent 300 ohm impedance match over the entire VHF range.
- Extremely narrow yagi type forward lobes, with no side lobes and negligible rear lobes.
- Single lead . . . no switching . . . no interaction between the high channel elements and the low band elements.

The New Winegard Super 'Ceptor (Super Interceptor)

With Electro-Lens Focusing!*

Gives you—multi-element yagi performance, not on one channel . . . not on one band . . . but on every single channel in the whole VHF spectrum!

List price U.S.A. . . . Super 'Ceptor . . . per bay **\$34⁹⁵**
 (Stacking bars available)



THE PIXIE

Top all channel performance—at a low price—featuring unique improved conical type driven element—for high gain and uni-lobe directivity.

List price U.S.A. . . . PIXIE . . . per bay **\$14⁹⁵**
 (Stacking bars available)

The author joined RCA in 1930, shortly after graduation from Cooper Union Institute of Technology. For seven years he served as chief factory engineer for power tube manufacturing at the company's Harrison, N. J., plant, and then as factory manager for power, receiving, and cathode-ray tubes. Mr. Smith was appointed commercial manager of RCA power tube sales in 1938, and two years later he became product manager for all RCA tube products. In 1951, he became manager of sales operations, and two years later was appointed to the newly-created post of General Marketing Manager for the RCA Tube Division, with responsibility for all direct marketing and sales of RCA tube products. He was appointed Vice-President and General Manager of the RCA Tube Division in September, 1954.



NATIONAL TELEVISION SERVICEMEN'S WEEK

By **DOUGLAS Y. SMITH**
Vice-Pres. & Gen. Mgr., Tube Div.
Radio Corporation of America

SINCE 1946, more than 32,000,000 television receivers have been installed and maintained in American homes. The magnitude of this achievement can be realized only in consideration with the relative youth of commercial television, the complexity of home receivers, and the small membership of the industry service fraternity, which during the introductory years of commercial television numbered only 50,000 to 65,000.

To these technicians and dealers goes much of the credit for the quick transition of commercial television from a laboratory development to a truly national service. However, so quick and skillful have been their achievements in making television a working reality in the living room, that service technicians have tended to become the taken-for-granted men of the electronics industry.

Because it believes that tribute is long overdue to the thousands of skilled technicians who have contributed so much to the success of commercial television, the *Radio Corporation of America* is sponsoring a "National Television Servicemen's Week" during the period of March 7 to March 12. It is our hope that during this period, those who make, sell, and enjoy home television equipment will give appreciative thought to the service industry and the "mountains" they have moved since 1946.

Electronics is a constantly changing and expanding science. Its knowledge does not come easily or quickly. The technician or dealer who hangs out his service shingle in the neighborhood can do so only after a considerable investment of time and money in education. Once established, he must continue his education with refresher courses to keep abreast of latest developments in electronic equipment and servicing techniques. He must keep his shop in tune with advances, too, equipping it with the latest in electronic test equipment and devices for top efficiency.

In other words, the trained technician is a professional who has worked hard and long to acquire his knowledge and skills. It is our hope that "National Television Servicemen's Week" will drive these facts home to many who are unaware of the sacrifices and efforts which have qualified the neighborhood service technician

for his profession and responsibilities.

Although the *Radio Corporation of America* has initiated this tribute, it is our hope that the entire electronics industry will adopt and support it—not only this year but as an annual gesture.

To focus maximum industry and consumer attention on service technicians, *RCA* is sponsoring a coordinated advertising and promotion campaign on both the national and local levels. This campaign will utilize such mass-circulation media as *Life* magazine, the *NBC* "Color Spectacular" television program, and the "Sid Caesar Television Show." Additionally, radio spot announcements and newspaper ads have been provided for co-sponsorship by *RCA* tube distributors.

We believe that this observance provides the neighborhood service technician with an unprecedented opportunity to enhance his local prestige—to present himself and the profession he represents in a new light before his customers. It is our hope that all service dealers and technicians will capitalize on this opportunity locally.

To encourage maximum dealer participation, *RCA* will award prizes to the dealer or technician in each of eight sales regions who displays the most initiative and originality in promoting "National Television Servicemen's Week" in his own trading area. Actually, this is a contest in which all participants win, for the real prize is increased prestige and professional standing where it counts the most.

To aid the neighborhood dealer in his promotion efforts, a variety of display, advertising, and direct-mail material for use at the point-of-purchase is available. A special electronic statuette, which symbolizes the theme of the tribute (shown here), is also available to service dealers.

This concentration of national and local effort in a five-day period may very well be supplemented by contributions from others in the electronics industry. *RCA* invites all who deal with or are served by the national servicing fraternity to join in this salute and to take the steps necessary to make "National Television Servicemen's Week" an annual tribute, from those who make, sell, and enjoy electronic equipment to those who keep it operating at peak efficiency in the home.



FREE 1955 EICO CATALOG!

Tells you how to SAVE 50% on
your test equipment costs!

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THE LARGEST MANUFACTURER OF ITS LINE IN THE WORLD

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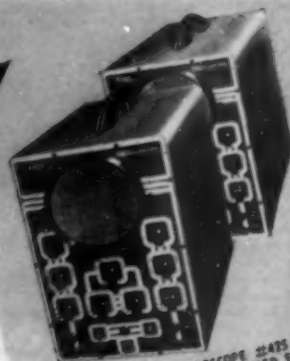
THE INDUSTRY'S MOST COMPLETE LINE OF KITS & INSTRUMENTS
1.3 MILLION EICO INSTRUMENTS IN USE THE WORLD OVER -
SAVE 50% - BUILD 'EM IN ONE EVENING... THEY LAST A LIFETIME

the Exclusive EICO Radio-Good GUARANTEE

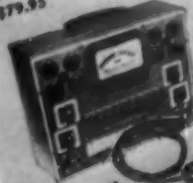
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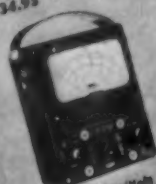
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6V & 12V BATTERY
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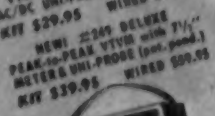
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TRANSFORMER & YOKE
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SEND FOR FREE CATALOG R-3
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Prices 25% higher on West Coast



NEW! #2752 PEAK-TO-PEAK
VTVM WITH DUAL-PURPOSE
AC/DC UNI-PROBE (not post.)
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NEW! #2349 DELUXE
PEAK-TO-PEAK VTVM WITH 7 1/2"
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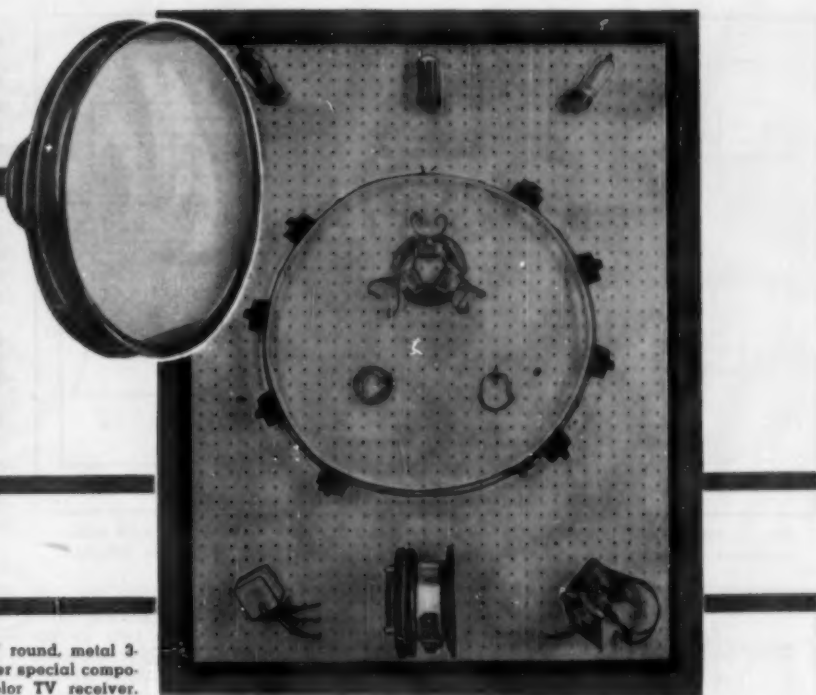


A PROBE FOR EVERY PURPOSE

SIMPLIFIED RCA COLOR RECEIVER

By
WALTER H. BUCHSBAUM
Television Consultant
RADIO & TELEVISION NEWS

Shown here are the RCA 21" round, metal 3-gun color picture tube and other special components used in the 28-tube color TV receiver.



Here is a complete analysis of the new circuits in the RCA 28-tube color set, hailed by many as the "color 630."

WHEN the first RCA 530 receivers were shown, back in 1947, few people realized that this represented the cornerstone of a fast-growing pyramid of better, cheaper, and more plentiful TV receivers. Remembering those early days of television and studying the new RCA simplified color receiver, we are inclined to name it the color 630. Using only 28 tubes, two less than the original 630, this set incorporates a 21-inch round color picture tube, a far cry from the 10BP4 used in the first 630 sets. The performance of this color set is as good as any seen earlier, and it certainly presents a very acceptable picture.

When RCA unveiled this new color receiver, other large TV manufacturers were handed all the necessary data as part of their licensing arrangement. This allows them to produce color TV sets based on the same or similar circuits and offers their engineers a chance to further improve the RCA designs.

For the service technicians this means that the majority of the new color receivers due to come out now will use all or some of the novel features of the RCA 28-tube set. It is with this in mind that we describe the new and outstanding features of the simplified color receiver, leaving the circuits which have been explained in RADIO & TELEVISION NEWS before as parts of the block diagram only. Emphasis will be placed on explaining those features which are completely new and are bound to find wide application in the new color receivers.

Over-all Design Features

Fig. 5 shows the entire RCA 28-tube

color receiver with the rear, top, and side panels removed for easy access. The entire receiver chassis is a single piece, mounted upright alongside the picture tube. The 21-inch round color picture tube uses a metal envelope which is covered by a plastic insulating sleeve. Support for the tube is provided by a ring near the junction of the neck and funnel, which forces the entire tube against the plastic front panel and mask assembly. Shielding is provided for the deflection yoke. Just behind the deflection yoke is the convergence coil assembly, purity magnet, and blue beam positioning magnet, all of which are used with other large 3-gun color picture tubes.

As shown in Fig. 5, the receiver chassis itself is not much larger than many of the earlier monochrome sets, although the high voltage section needs more space and better insulation. The high voltage cable going to the picture tube socket provides the focusing potential for all three electron guns. Since the metal envelope serves as second anode, there is also a high voltage lead going in that direction. One of the new features of the 21-inch round tube used in this receiver is the permanent magnet ring assembly near the screen of the picture tube in place of the old field neutralizing coil.

Even more interesting than the physical appearance of this receiver is its electrical arrangement as shown in the block diagram of Fig. 1. The v.h.f.-u.h.f. tuner is special only in its closer

tolerances on bandpass and oscillator drift characteristics, otherwise its operation is the same as for black-and-white.

The i.f. section employs a total of 4 stages. A special bifilar "T" trap is used to provide the necessary attenuation for the sound i.f. and by using separate detectors for the sound and video signal, further separation of the two signals is obtained. Actually, the detector used for the sound is peaked towards the i.f. range of the color subcarrier, which is only about 900 kc. from the sound i.f. At the chroma-sound detector output a sharply tuned 4.5 mc. trap doubles as sound rejection for the chroma channel and as sound take-off coil for the sound channel. This latter section is essentially the same as most black-and-white inter-carrier sound sections. A ratio detector at 4.5 mc. is used, followed by a standard audio amplifier.

The brightness-signal detector section feeds a delay line and then the signal is amplified and passed on to all three cathodes in the color picture tube. The sync separator utilizes the high level brightness signal and, in conjunction with other sync circuits, provides horizontal and vertical synchronizing pulses.

Sync and sweep circuits are very much like those used in monochrome receivers with a blocking oscillator circuit used in the vertical, and a phase detector type a.f.c. in the horizontal section. More saw-tooth power is

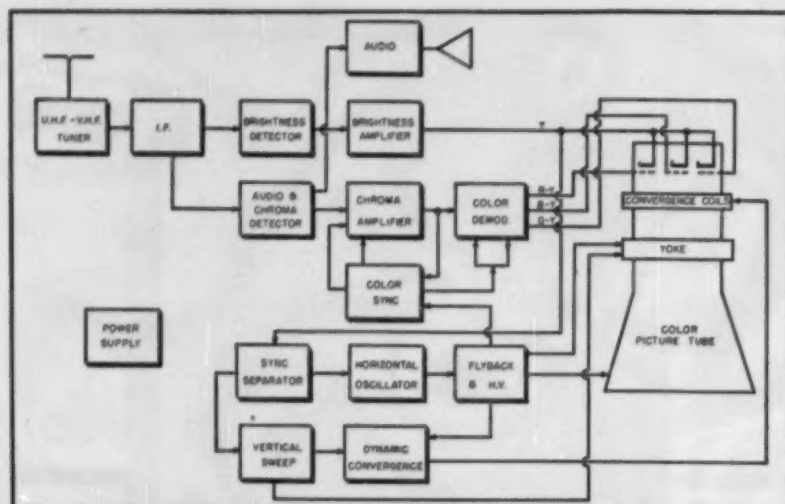


Fig. 1. Block diagram of the RCA set. Comparing this with the previous RCA color receivers using the 15" tube discloses the simplification and economies effected.

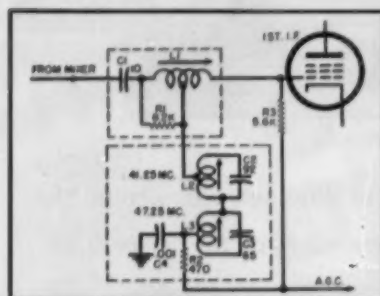


Fig. 2. Schematic diagram of the bifilar "T" trap which reduces very sharply the amplitude of the sound I.F. carrier.

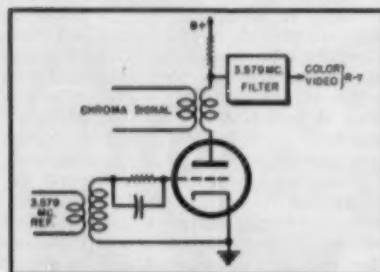


Fig. 3. Simplified diagram of the triode color demodulator circuit used by RCA.

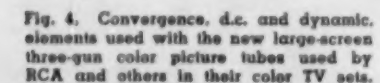
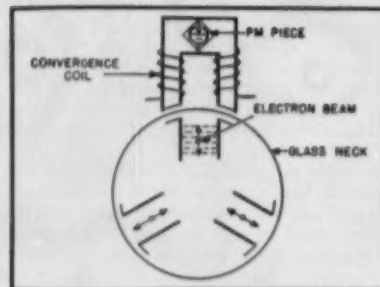


Fig. 4. Convergence, d.c. and dynamic elements used with the new large-screen three-gun color picture tubes used by RCA and others in their color TV sets.



three control grids of the tricolor picture tube. The three grids receive the red, green, and blue color difference signals, while the three cathodes are driven by the brightness signal. Thus, the addition of the Y signal to each of the three colors is accomplished directly inside the color picture tube.

While the double-triode demodulator circuit is far more economical than any of its predecessors, its operation also requires less adjustment and eliminates many of the variables found in earlier systems. The result is a surprisingly stable demodulator, simple to produce, still easier to adjust, and certainly a great step towards faster color TV servicing.

The block diagram is completed by the power supply which uses a power transformer and selenium rectifiers, and provides 200 and 400 volts "B+" as well as a small negative potential. This latter is obtained by returning the secondary to ground through the vertical and horizontal centering controls.

There are various minor innovations in practically every section of this receiver, but in this article emphasis will be placed only on the convergence section, the demodulator and chroma channel, and the operation of the bifilar "T" trap in the i.f.

The need for at least 60 db of attenuation of the sound i.f. carrier and the specification that this must be done in a very narrow frequency band led to the use of a bifilar "T" trap. This trap provides considerable attenuation without overshoot or ringing.

Fig. 2 shows the double-tuned bifilar trap used in the new RCA 28-tube receiver. Two separate traps are employed, one tuned to the sound i.f. and the other to the adjacent channel sound carrier, both connected in series. All three coils are slug tuned and their alignment presents no particular problem. The tapped tuning coil, L_{11} , is set in accordance with the i.f. bandpass specifications and each of the traps is aligned individually for maximum rejection at its respective frequency. Another sound i.f. trap is used in the brightness detector stage.

Triode Demodulator

Perhaps the most significant innovation presented in the new RCA 28-tube color receiver is the demodulator and matrix network. In this receiver a single 12BH7 provides the complete decoding action with sufficient signal output to drive the three kinescope grids directly. Before discussing the actual circuit, it is important to understand how a triode demodulator works. Consider the circuit of Fig. 3 which shows a triode used to detect the chroma signal. Theoretically either the I , Q or $R-Y$, $B-Y$ signals could be detected here, depending on the phase relationship of the reference signal and the bandwidth of the output filter. Since the color difference system is used in the practical circuit, assume that the triode in Fig. 3 produces $R-Y$.

If no signal appears at the grid, the plate current of the triode will depend on the plate voltage. In other words, the triode acts like a diode detector, for amplitude modulation. When a signal is applied at the grid, the plate current is dependent both on the instantaneous grid voltage and the plate voltage. This is the same action as obtained in a conventional demodulator such as the 6AS6, where the plate current is a function of the control and suppressor grid signals. In the triode it is necessary to choose operating points for plate and grid signal amplitudes so that the linear portion of the tube characteristic is used. Note that there is a special trap in the plate circuit which removes the 3.579 mc. reference signal and the color subcarrier.

When using two triode demodulators, the chroma signal applied to each tube and the load resistors would have to be adjusted in relation to the respective color signals to obtain the proper amplitudes. Also necessary for such a demodulator are relatively large chroma signal and reference signal voltages.

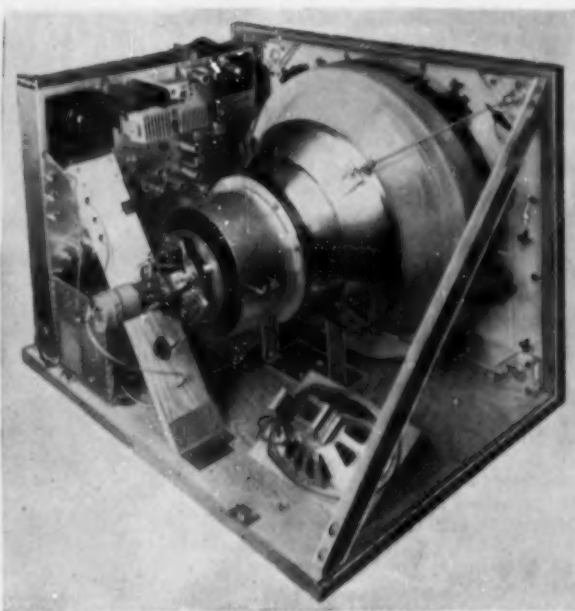
Now consider the block diagram of Fig. 6 showing the entire chromaticity section of the new RCA set. Two stages of amplification are used with a bandpass of about 1 mc. centered at 3.579 mc. This provides sufficient driving power for the 12BH7 demodulator. Note that the color reference burst is obtained from the second chroma stage and that the color phase detector is utilized to provide an a.g.c. bias which controls the gain of the first chroma amplifier. This circuit helps maintain constant chroma signal for the demodulator and generally adds to the stability of the receiver.

The complete demodulator circuit is shown in Fig. 7. A single transformer drives the plates of both triodes, but in order to obtain the difference in amplitudes required, the ratio of the two secondaries is 1 to 1.41. The two plate load resistors are in the ratio of 2 to 5. When the correct phase and amplitude of reference signals are applied at the two grids, the red and blue color difference signals are demodulated. It is possible, by using these two signals in proper phase and amplitude, to obtain the green color difference signal. In the double-triode circuit of Fig. 7 the green matrixing action is performed directly in the cathode of the 12BH7. By joining the cathodes of the two triodes, the total cathode current is a function of the R-Y and B-Y signals. The plate load and cathode resistors are so chosen that the green color-difference signal appears directly at the common cathode. Thus, the double triode circuit of Fig. 7 performs not only the demodulating, but also the matrixing functions.

The coils and series resistors in each kinescope grid lead help in suppressing harmonic radiation of the 3.579 mc. reference signal.

One of the features of this circuit is the d.c. coupling to the picture tube. The three color difference signals are

Fig. 5. View of an RCA color TV receiver of the type described in this article. Note the lack of a field neutralizing coil and CRT tube shielding.



applied directly to the three grids while the brightness signal is d.c.-coupled to the three cathodes. Thus, the Y signal is added inside the color picture tube to the three difference signals and the full three-color presentation appears on the screen. Since d.c. coupling is used throughout, no d.c. restorer circuits are needed.

Magnetic Convergence

Many of our readers know of the convergence problems in the earlier shadow-mask color picture tubes. In those tubes, a special element, the convergence grid, carried a d.c. potential as well as a vertical and horizontal parabolic voltage, which helped the three electron beams to converge at the shadow mask. In addition, a set of small magnets was located around the neck of the tube to bring these three colors into registry.

In the large-screen color tubes available now, convergence is accomplished by three magnetic fields, each acting only on its respective electron beam. As shown in Fig. 4, small steel strips inside the neck of the tube form two magnetic poles when an external horseshoe magnet is placed over them. Each set of two poles has an electron beam in its field and since the field is confined between these poles, the action of one set of poles has little effect on any of the others. Each horseshoe magnet actually consists of two ferrite pieces with a small permanent magnet cylinder as shown in Fig. 4. This permanent magnet can be rotated, and thereby adjusts the d.c. convergence of its electron beam. In addition, a coil is wound over each ferrite leg and through this coil goes the vertical and horizontal convergence current. In addition to the convergence magnets and coil assembly there is also a blue positioning magnet, similar in appearance to an ion trap magnet, which will

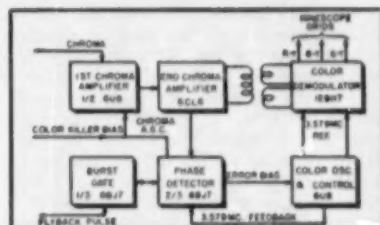
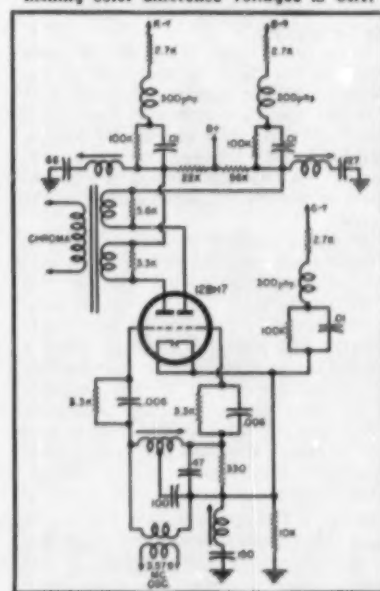


Fig. 6. Block diagram of the chrominance circuits. Note the chroma a.g.c. feedback.

allow lateral motion of the blue beam. We know from the earlier electro- (Continued on page 124)

Fig. 7. Complete schematic diagram of the double-triode color demodulator furnishing color difference voltages to CRT.



TELEVISION servicing has robbed radio repairing of much of the attention it merits. Many shops make no attempt to drum up radio service business, or even reject such business outright. And yet, sales of radio sets have held up fairly well in this TV era; millions of AM receivers are sold yearly, and their servicing can be profitable.

For the benefit of those who've forgotten some of their radio service techniques, as well as others just entering the field, this outline of rapid troubleshooting procedures is presented. Even an experienced man can lose valuable minutes on a repair, when he's gone rusty; the novice is, of course, apt to lose much more time. Due to space limitations, we will restrict ourselves to more or less common troubles, and cover only a.c.-d.c. home receivers (excluding straight a.c. sets, portables, and auto radios). The emphasis throughout will be on shaving off valuable minutes from repair time by using the proper sequence of tests.

Dead Set

Tubes are dark: Test with an ohmmeter between both line plug terminals with the switch on. If continuity is read, either the power outlet is defective, or the plug wasn't making good contact with it. If continuity is not read, and a quick inspection of the plug reveals no visible defect, the next step is to resistance-check the tube heaters. (Don't overlook the "on-off" switch, especially if a peculiar click is heard when the switch is turned on. Shorting out the switch with a screwdriver will check it.)

If each tube heater shows continuity, a resistance check of the line cord should be made next. If this test reveals no defect, the tubes should be rechecked in a tube tester. Once in a while, a tube with a defective heater will check OK on continuity, and will reveal its defect only when heater voltage is applied.

Some tubes light: When one or more tubes do not light, or feel cold to the touch, a shorted tube is indicated. Test first (in the tube checker) the tubes that light up, then check the others, watching for leakage between elements. A cathode-to-heater breakdown is generally responsible for the trouble.

All tubes light: If no sound, not even a faint hum, can be heard when you put your ear close to the speaker, and a 35Z5-type tube (with a pilot lamp in the plate circuit) is present, note whether the pilot light blinks when a station is tuned in and the volume control is advanced. If it does, trouble in the voice coil is generally indicated.

Try moving the speaker cone in and out, to check whether the voice coil is "frozen." Sometimes metal filings, radio cement, a misadjusted movable core (in a PM speaker, see Fig. 1), or some other defect, keeps the voice coil assembly from moving freely. If the speaker cone movement is unimpeded,

check for an open or short in the voice coil. To make the required tests, disconnect one voice coil lead from its terminal, then connect an ohmmeter across the two leads (one still connected, the other free); now, rub the free lead with the ohmmeter test prod. A faint but unmistakable scratching sound should come from the speaker. If such a sound is *not* heard, and continuity is read across the voice coil, a short in the latter is indicated. Try a new speaker, in this case.

A test PM speaker that has an output transformer mounted on it can provide a fast substitution.

An open or shorted output transformer secondary is indicated when voice coil "scratch" is obtained, pilot light flicker on stations is noted, and the set won't play. A resistance check will reveal the first defect, substitution of a test speaker will uncover the other.

If the pilot light does *not* blink, and no hum or other sound is audible in the speaker, proceed as follows:

Check the rectifier and power amplifier tubes in the tube tester. (Before replacing a defective rectifier—one whose emission reads zero—check for a shorted electrolytic capacitor to avoid assassinating a new tube. Such a test can be made from the top of the

socket, between cathode and heater contacts, to save time.)

If the rectifier and power amplifier tubes check OK, test the other tubes for a short circuit. When no tube is found faulty, test the speaker field. To do this in the case of a PM speaker, simply hold a screwdriver near its permanent magnet. If the pull seems exceptionally weak, substitute a test speaker. When the speaker is an electromagnetic one (used in many of the older sets) check for field pull by holding a screwdriver close to the center core. If a dust felt is over the core, use a sharp, thin, pointed tool to pierce the felt without impairing its dust-barrier action. If the tool is not markedly attracted, either the speaker field is open, or no rectified d.c. voltage is present.

When the speaker field serves as a choke, d.c. voltage tests at either side of it to ground will reveal the presence of an open—as well as indicate whether the rectifier is working properly. If the rectifier output voltage is absent or too low, resistance and filter capacitor bridging tests will uncover the trouble.

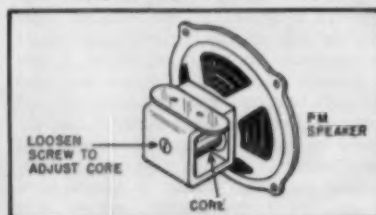
If the speaker field is connected between one cathode of a dual-cathode rectifier and ground (as is the case in some old sets, see Fig. 2) the field coil will have to be resistance checked. A reading of about 3000 ohms from the cathode to ground should be obtained, if the field coil is normal.

The next step is to check the voltages between the power amplifier tube elements and ground. Also check the voltage drop across the output transformer primary; the presence of no voltage, or very little voltage here indicates a short across the primary, possibly in the bypass capacitor that is often in parallel with the latter.

All tubes light, slight hum is audible: Remove the detector-first audio amplifier tube, listening for a clicking sound,



Fig. 1. To adjust the core of a PM speaker merely loosen the screw indicated. A misadjusted or shifted core may be responsible for distortion.



A.C.-D.C. RADIO SERVICING



By
SOL HELLER

You can service radios in no time flat by following the procedure outlined here—also effective for hi-fi.

or put your finger on the high side of the volume control, and note whether a substantial hum or screech becomes audible. If the click or hum is heard, the audio section, speaker, and rectifier can be absolved of blame.

Remove the tubes preceding the second detector one at a time, working back to the converter. A click should be heard each time a tube is removed; these clicks should increase in intensity as you move back toward the first tube. If a tube is found whose withdrawal produces no click, or only a faint click, substitute a known good tube for it. If the set still won't play, try voltage and resistance tests in the stage of the replaced tube.

If no click was heard when the detector-first audio tube was removed, remove the power amplifier tube, listening for a click. If one is heard, either the detector tube or circuit is defective. A very common trouble to look for is an open coupling capacitor.

In cases where click tests seem inconclusive, use a long wire or (preferably) a lead going to the shop's external aerial. Rub this wire against the grid connection of each tube, working back towards the first tube. Noise, increasing in volume as more stages of amplification are added, should be audible. When a stage is reached from which no sound, or only a faint sound, can be obtained, trouble in that stage is indicated.

When tube substitution, voltage, resistance, and capacitance bridging tests reveal no trouble, the set is probably misaligned.

No stations are received, but set sounds alive: Trouble in the oscillator section of the converter stage is probably present. Substitute a known good converter tube.

If rotating the tuning capacitor causes static noises to be heard, the oscillator section of the tuning capaci-

tor should be checked for a short. Next, check the converter stage to localize the defect.

Set Plays

One or more stations are not received: The trouble may be in the tuning capacitor i.e., bent plates, and dust or metal particles between the plates.

If several stations are missing at one end of the band, try a new converter tube. Also check the alignment.

When it is uncertain whether oscillator trouble or misalignment is responsible for the absence of most stations, try shorting the stator of the oscillator tuning capacitor to the rotor. If the symptoms remain the same, the oscillator is inoperative.

An open built-in antenna or antenna coil, or a loss of capacitance in an antenna coupling capacitor, or a.v.c. bypass capacitor may also eliminate one or more stations.

Volume below normal: Check the power amplifier and detector-first audio tubes. If these are good, bridge the coupling capacitor leading to the power amplifier grid and note results.

If the volume control has little or no effect, the coupling capacitor between the center tap of the volume control and the first audio tube grid should be bridged. Next try moving

the speaker cone in and out. Sometimes a partly frozen cone (discussed previously) is responsible for considerably reduced volume. Measure the "B" voltage; test the rectifier and its circuit, if this voltage is too low.

When an electromagnetic speaker is connected between one cathode of a dual-cathode rectifier (such as a 25Z5) and ground, an open field coil may be the cause of very low volume. If the set uses a PM speaker, substitution will tell you if the magnet is at fault.

Try bridging the coupling capacitor in the audio section, the power amplifier cathode bypass capacitor, and the antenna coupling capacitor (if one is present).

If placing your hand on the built-in antenna causes the volume to increase, the primary of the loop antenna may be open or shorted. About $\frac{1}{2}$ ohm is the normal resistance for the loop. In determining whether a short is present, substitution of another unit may be necessary. Do this when no other trouble is readily apparent.

A slight degree of i.f. misalignment will reduce volume considerably. To test for this, make a pencil mark on the i.f. cans or chassis, indicating the trimmer or slug positions. Then readjust the trimmers or slugs slightly, noting whether volume returns to normal. If reception isn't louder, return the trimmers to their original settings.

When the reduction in volume is relatively slight, but still appreciable, check if the pilot light is burnt out. An open pilot lamp can reduce volume, particularly when the pilot lamp is being fed from a ballast tube. When the pilot light is in parallel with a section of a 35Z5 heater, volume is also apt to go down when the lamp burns out.

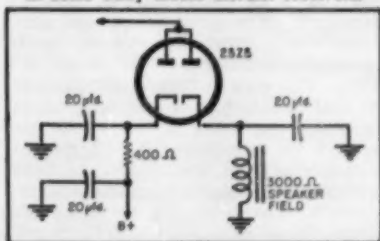
If weak reception is accompanied by a normal level of background noise, and an outside aerial is present, use a long length of wire outside the window as a test aerial. Improvement in reception indicates an open in the original aerial. (This also serves as a test of a loop antenna.)

Distortion: When distortion is present and all stations are coming in, the trouble generally lies either in the audio section or power supply. If the distortion is a "creeping" one that starts after several minutes of normal reception and gradually becomes much worse, try a new power amplifier. If continuous distortion is present, turn down the volume control and check for residual hum. If this hum is even slightly above normal, try bridging the filter capacitors and note results.

A leaky coupling capacitor to the audio power amplifier is a common source of trouble. Check the grid-to-ground voltage of the power amplifier; if an appreciable positive voltage (above $\frac{1}{2}$ volt) is present, disconnect the coupler and try a new one in its place. Sometimes the unit present may have a leak in it that doesn't affect the grid-to-ground voltage very noticeably (due to a flow of grid current that causes a bucking voltage to

(Continued on page 90)

Fig. 2. Diagram showing the connection of an electromagnetic speaker field in some early model a.c.-d.c. receivers.



NEW

TV AND RADIO TEST EQUIPMENT

By

RHYS SAMUEL

Tube Div., Radio Corporation of America

*Can you use your present TV test equipment for color TV?
What new equipment will you need? Here are some answers.*

NOT since the early TV days of 1946 have service technicians received such attention from test equipment manufacturers as they are getting this year. The host of test instruments and accessories available today is greater than ever before. Although many of these new instruments are simply modified or improved versions of familiar equipment, several new types of instruments have been introduced for servicing color TV receivers.

The types of instruments a service technician requires are naturally determined by the types of jobs he encounters. For the servicing of v.h.f. and u.h.f. black-and-white TV receivers, which are still the bread-and-butter activity of the technician, the basic instrument types needed—vacuum-tube voltmeter, oscilloscope, sweep and marker generators—have not changed. The series-string TV receiver, which is rapidly gaining in popularity, will not require special equipment. In the expanding hi-fi audio field, the v.t.v.m., audio voltmeter, oscilloscope, audio generator, and square-wave generator are even more valuable than before. In the service of radio receivers, which continues to be a multi-million-dollar source of service revenue, the v.t.v.m. and r.f. signal generator are still the most needed test instruments.

The main problem confronting service technicians in the market for new test instruments at this time concerns the adaptability of the equipment to color television. The three questions asked most often are:

1. Will my present black-and-white TV test equipment be good for servicing color TV sets?
2. If I buy needed test equipment

now, will it be obsolete when color TV sets start coming in?

3. What new types of equipment will I need for color TV?

The following discussion of different types of test instruments for the television, radio, and audio fields should answer these questions and other questions of current interest to the radio and television technician.

Voltmeters and v.t.v.m.'s—Vacuum-tube voltmeters and voltammeters will be more useful than ever in color TV servicing. The complexity of color television circuits has increased the importance of voltage and resistance measurements. Of special importance is the need for high-voltage measuring equipment. Because the regulated ultor (second anode) voltage of color kinescopes must be set accurately before other circuit adjustments are made, high-voltage (multiplying) probes will become necessary accessories for the service voltmeter. Color receivers use ultor voltages up to approximately 30,000 volts, therefore, high-voltage probes should be rated for 40,000 to 50,000 volts to provide an adequate margin of safety.

Oscilloscopes—The two main functions of the TV service oscilloscope, signal tracing and response-curve display, are a necessary part of color TV servicing. The scope must meet additional requirements, however, to be generally satisfactory for color TV jobs. The most exacting requirement is that the frequency response be essentially flat from a few cycles per second to approximately 4.5 mc. for measurement of the color sync burst and for troubleshooting in chrominance circuits. For color TV servicing, the scope should have built-in voltage cali-

bration or an external calibrator should be used, as explained later, to permit measurement of the peak-to-peak amplitude of the burst signal. Because the color sync circuits have very high impedance, the scope must also present a high impedance to the test circuit to prevent excessive loading and detuning. Consequently, a low-capacitance (high-impedance) probe is required. To compensate for the loss in sensitivity introduced by such a probe, the scope should have relatively high gain.

Sweep generators—Because all of the color information is contained in the 2 to 4.1 mc. region of the over-all TV r.f.-i.f. response curve, tuners and picture i.f. amplifiers of color television receivers must be aligned with a high degree of accuracy. Any loss of gain in these portions of the circuit can cause poor color sync-lock action and color "contamination." Sweep generators, therefore, should provide essentially flat voltage output throughout the frequency range covered to insure a faithful representation of circuit bandpass. A low-frequency sweep voltage is also required for alignment of luminance and chrominance circuits. Servicing of these circuits requires the use of a video sweep generator which has flat output from approximately 50 kc. to 4.5 mc. Few conventional TV sweep generators can meet this requirement without modification or the use of external accessories.

Marker calibrators—The marker calibrator is required in TV servicing to furnish a marker of high accuracy for use in locating particular frequencies on sweep response curves for checking bandpass of circuits, and for setting traps to a specified frequency. The calibrators usually employ a variable-frequency oscillator having crystal calibration facilities for checking accuracy of the output marker. The calibrator should be able to furnish reliable markers on all the desired sound and picture carrier frequencies, as well as a 4.5-mc. marker for sound i.f. amplifier and sound trap alignment.

For color TV use, markers are also required at the important intermediate frequencies, including that of the color subcarrier (42.17 mc.) and the "knee" or drop-off point on the over-all i.f. response curve (41.65 mc.). Bandpass measurements in the video and chrominance circuits require frequency markers at 0.5 mc. (for Q filter, R-Y, B-Y, G-Y demodulators), 1.5 mc. (for I filter), 2.5 mc. (for bandpass filter), 3.58 mc. (color subcarrier frequency), and 4.5 mc. (sound trap frequency).

Dot generators—Dot generators are essential instruments for color TV servicing, and will become standard equipment both for service calls and on the bench. These instruments produce a pattern of evenly spaced white dots on a black background on the color kinescope screen for use in adjustment of both d.c. and dynamic convergence circuits. When the convergence adjustments of the color TV receiver are set correctly, the three electron beams of the color kinescope strike their corresponding red-emitting, blue-emitting, and green-emitting phosphor dots in the correct phosphor-dot groups over the entire useful area of the tube screen. Because convergence adjustments must be set correctly before other adjustments are made, a dot generator is indispensable.

Service-type dot generators which have r.f. output, video output, or both, are available. Dot generators which supply r.f. output on one or more of the v.h.f. channels can be connected directly to the antenna terminals of the TV receiver. Dot-pattern signals within the video range can be fed directly to the color kinescope or into the video amplifier of the color receiver.

Several different models of dot generators are now available for color TV servicing.

Color-bar generators—The color-bar generator is used for checking over-all operation of color TV receivers, and for adjusting color phasing and matrixing in the chrominance section of the receivers. The primary requirement of these instruments is that they furnish signals which are inherently accurate and have a fixed phase relationship at all times. The signals from the color-bar generator are fed into either the antenna terminals of the receiver or the video amplifier section. Prescribed adjustments can then be made in the phasing and matrixing sections of the receiver. The kinescope is used as the indicator device. Unless a color-bar generator produces extremely stable signals having accurate phase relationship, it cannot be used as a reference standard. A generator which provides a color-bar signal for injection at the antenna terminals must duplicate, in simplified fashion, the broadcast color signal. Therefore, these generators must supply a signal which includes a picture carrier, sound carrier, sync pulses, and a color subcarrier modulated with accurately phased color signals. A few different models of color-bar generators are now available, although they differ con-

siderably in design and output-signal characteristics.

TV accessories—A number of test accessories, not all of which are new, are extremely valuable in the service shop or tool kit. A recent device, which promises to become indispensable for servicing series-string TV and radio receivers, is the universal heater continuity tester. This device, designed to test nearly any tube type used in TV receivers and a.c.-d.c. radios, employs a neon lamp to indicate instantly whether a tube heater has burned out. It is only necessary to plug the suspected tube into the appropriate socket of the tester to check heater continuity.

An isolation transformer is recommended to provide a safety factor in the servicing of a.c.-d.c. and transformerless receivers. This transformer effectively isolates the "hot" chassis from the power line, thereby greatly reducing shock hazards and the danger of damage to expensive test equipment because of improper test-lead connections and accidental short circuits. These transformers will be especially useful on the series-string TV sets.

Troubleshooting in TV deflection circuits can often be speeded by use of a flyback tester. These testers are connected directly to the deflection-output sections of the TV receiver to indicate the condition of the flyback transformer and deflection yoke.

The increased use of oscilloscopes for peak-to-peak voltage measure-

ments has accentuated the need for voltage calibrators. These calibrators, which are used with scopes which lack frequency-compensated and voltage-calibrated input circuits, provide sine-wave or square-wave output at one or more preset peak-to-peak values. The scope probes are connected to the output terminals of the calibrators, and the scope vertical-gain adjustments are set to give the desired deflection.

Cross-hatch and vertical- and horizontal-bar generators are extremely useful when no test signal is available for linearity adjustments. The output from the generator is usually fed directly into the antenna terminals of the TV receiver.

Because the use of selenium rectifiers has greatly increased, specially designed selenium-rectifier testers are being used as a quick means of checking the condition of these components. The rectifiers can be checked for forward and reverse current characteristics under load conditions. A meter is used as the indicating device.

Radio Test Equipment

The isolation transformer, v.t.v.m. or voltohmmeter, and r.f. signal generator are sufficient major equipment for nearly all routine radio repairs. The r.f. signal generator is excellent for troubleshooting by signal injection, and is essential for alignment of r.f.

(Continued on page 127)

List of color and black-and-white TV test equipment now available. Only those categories are listed that are described in the article. Most of the manufacturers listed also market other types of service instruments, many of which are new.

DOT GENERATORS

Hickok Model 650C
Jackson Model 712
Philco Model G8005
RCA WR-36A

Simpson Model 434
Superior Model TV-50
Sylvania Type 506
Winston Electronics Inc. Model 160

COLOR-BAR GENERATORS

Hickok Model 655XC
Hycon Model 618
Jackson Model 712
RCA Model WR-61A

Simpson Model 430
Triplett Model 3434
Winston Model 150

COLOR ACCESSORIES

Simpson Model 406 Chromatic Amplifier
Simpson Chromatic Probe

Winston Model 950 Rainbow Computer

OSCILLOSCOPES FOR COLOR

Eico Model 460
G-E Type ST-2A
Heath Model 0-10
Hickok Model 640
Hycon Model 617
Jackson Model CHO-2
Philco Model 58206
Precise Model 300

Radio City (RCP) Model 534
RCA Model WO-78A
Simpson Model 458
Supreme Model 665
Sylvania Type 403
Triplett Model 3441A
Weston Model 885
Winston Model 550

FLYBACK AND YOKE TESTERS

Cornell-Dubilier Model BF-80
Eico Model 844
RCP Model 123
Seca Model FB-4

Teletest Model FT 100*
Transvision Component Tester
Winston Model 810

SELENIUM RECTIFIER TESTERS

Jackson Model 710
Transvision Component Tester

Triplett Model 3423

VACUUM TUBE HEATER TESTERS

G-E Series Heater Checker
Service Instruments Model FC3
D. W. Thomas Engineering, Inc., Model 1402

Triplett Model 3423
Visulite Co. Model 101C

* Does not test yokes.

REPORT ON TV SERVICE LICENSING

By CHARLES TEPPER

Service Editor, RADIO & TELEVISION NEWS

The New York City bill may serve as a model for many licensing bills. Here's a report on it and licensing.

MANY service technicians may be wondering why TV service licensing is such a hot topic right now. After all, contract servicing appears to be on the way out with its attendant evils, a uniform schedule of service charges is slowly being adopted nationwide, the Better Business Bureaus in general report fewer complaints. Well, it seems we have been "enjoying" the quiet before the storm.

More and more service operators have been affected by the cut-rate service boys who operate at low overhead, many times out of their cellars, and in the evening. The larger companies that advertise "\$1 service charge" and then stick the customer for all kinds of unneeded parts that many times are not even installed in the repaired receiver, are found out sooner or later, with the result that all service operators are branded as "gyps." This makes it difficult for the legitimate service operator to ask for and obtain a fair price for his service.

These are some of the reasons why, after many service dealers and associations fought service licensing bills when they were first proposed way back in 1947, and many times since, they have come out for city licensing now.

In the words of Max Leibowitz, president of the Associated Radio & Television Servicemen of New York, "In many metropolitan areas, an unscrupulous operator merely has to open up under another name in another part of town to continue his cut-rate and defrauding practices. It is this individual and his activities that are compelling the legitimate service operator to leave the industry and go into some other activity."

Perhaps if we look over some of the provisions of the licensing bill presently under consideration by the New York City Council we'll be in a better position to evaluate this whole situation.

To begin with, the law has this legislative declaration:

"It is hereby declared that the business of selling service contracts and servicing television receiving apparatus has become the subject of great abuse with the result that the public has been and is being victimized by irresponsible sales methods, unethical and financially unstable service organizations and inferior installation, maintenance, and repairs. The necessity for legislative intervention by the enactment of the provisions of this article is hereby declared as a matter of legislative determination."

Many service operators believe that the real abuses lie not in contract operations but in false and misleading advertising, and in cut-rate service charges with the resulting needless replacement of parts to jack up the service revenue.

The licensing bill recognizes four classes of licensees: service contractors, service dealers, technicians, and apprentices. The first two require a license costing \$25 with a yearly renewal fee of \$15. The technician license costs \$15, and is renewable each year for \$5. The apprentice pays \$5 for a permit and must renew it each year for \$5. The qualifications required for each class are to be determined by a supervisory committee composed of representatives from all applicable parties. Each applicant for a technician's license will be examined by a board consisting of two members chosen by means of civil service competition.

To qualify for a technician's license, the applicant must prove that he serviced TV receivers or tested electronic apparatus for at least twenty-one months prior to application or, that he graduated from a course in TV repair and maintenance from an accredited school and serviced TV sets for at least six months after graduation.

The bill makes it unlawful for any service dealer or contractor to employ an unlicensed technician or apprentice. Further, the service operator is obliged to furnish his customers with an item-

ized bill for all labor performed and parts used. Violators of this bill are subject to a \$500 fine, six months imprisonment, or both.

The bill, in itself, would perhaps not be so important nationally, if it were not that it will probably serve as a model for similar bills in other cities. Because of this, it would be well for service technicians and operators all over the country to consider the provisions affecting them very carefully.

What have been the points of opposition? Well, to begin with, the RETMA, representing the various set manufacturers, is against licensing. They feel that licenses will not curb the fraudulent operator. After all, many of the unscrupulous service boys could pass a test with ease, and many have been in "business" for over two years. What's to prevent them from obtaining licenses? The manufacturers also feel that the answer to poor servicing lies in education, an example of which is the course they have prepared for upgrading the service technician.

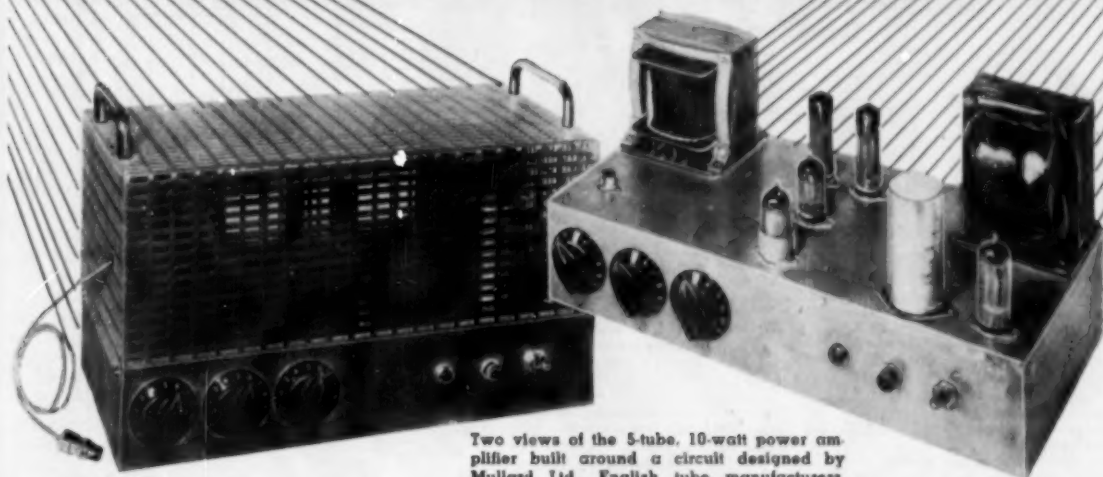
Supporters of the bill point out, however, that while unscrupulous operators may obtain a license, at the first sign of fraud their licenses can be revoked, and they can be fined or imprisoned. This, in itself, should serve as a deterrent to such operators. As far as education being a solution goes, supporters of the bill point out that they are not fighting ignorance but fraudulent business practices. Some of the most educated technicians are among those engaged in shady practices.

The bill has been supported by Brooklyn District Attorney Edward Silver. In an open hearing on the bill, he described the difficulty and involved proceedings he had to go through to trap and prosecute a TV service racket in Brooklyn recently. The time wasted, the expense to the taxpayers, and the subterfuge used would not have been necessary, he said, if this bill had been in effect. Despite all his trouble, he went on to point out, this company may still crop up again and be in business with nothing to stop them.

On the other hand, one service association believes that the law, as written, is too vague about the rules that will be laid down by the supervisory committee and the commissioner. They state: "The biggest single factor against this bill is that the license feature is too indefinite to insure that any undesirables may be kept out of the business or isolated in any way. In fact, such a law would most certainly license the incompetent."

Whether you agree with this evaluation of the bill and of licensing in general, or whether you decide that licensing will raise your profession in the eyes of the public and eliminate much of the bad reputation service has suffered is important. Your recommendations to your local government will affect the future of your business operations.

NEW BRITISH POWER AMPLIFIER



Two views of the 5-tube, 10-watt power amplifier built around a circuit designed by Mullard Ltd., English tube manufacturers.

ONE of the best circuits to come out of Britain in several years is the new Mullard-designed, 5-tube, 10-watt, high-quality amplifier to be described. It should be explained for the benefit of U.S. readers that Mullard Ltd. does not manufacture these amplifiers but designed the circuit around its latest audio tubes and released the circuit to British amplifier firms and English audiophiles. The circuit has now been released for publication in the United States by International Electronics Corp., 81 Spring Street, New York 12, N. Y., who represents Mullard, Ltd. in this country.

Since the design incorporates many unique circuit features, a brief description of the amplifier and its performance specifications might be in order. While the tubes in this amplifier are British-made, they are now available at many local distributors and all national parts houses so no attempt should be made to substitute American-made tubes in this particular circuit. Plans are under way to adapt this circuit to U.S. components but at the present such circuitry is not available.

Although the circuit uses only four amplifier tubes and one rectifier, the amplifier is sufficiently sensitive to be driven by most of the popular phono pickups without resorting to a preamplifier stage or stages.

Harmonic distortion has been kept to a very low figure, i.e., less than .4 per-cent at 10 watts output. The frequency response is both wide and level, being almost flat from 10 to 20,000 cps.

The circuit itself is fairly conventional. A single-ended, high-gain pentode (Mullard EF86) feeds a cathode-coupled phase splitter using the high-mu double-triode ECC83. The balanced output voltages derived from the

ECC83 are used to drive the grids of two EL84 pentodes in push-pull. Negative voltage feedback is applied from the secondary of the output transformer to the cathode of the input tube.

The Circuit

The amplifier includes a well-known type of tone control using a wide-range passive circuit. The treble control appears as R_m on the schematic diagram of Fig. 1 while the bass control is designated as R_n .

The tone control circuit produces an attenuation of about 12 times. Because of the high sensitivity of the amplifier (50 mv. at Y-Y with feedback) the tone control unit is suitable for use with a ceramic or crystal pickup without the need for a separate preamplifier tube.

The first stage of amplification is provided by the EF86 in a circuit having a gain of approximately 150 times. The negative feedback voltage from the secondary of the output transformer is introduced across the 100-ohm resistor, R_s , in the cathode circuit. In a feedback amplifier with a wide frequency response, stability can be achieved only if the required difference in phase is maintained between the input signal and the feedback voltage.

The EF86 has, accordingly, been coupled directly to the following stage in order to reduce the phase shift at low frequencies. The RC network, C_m — R_m , shunting the anode load produces an advance in phase which increases the stability of the amplifier at high frequencies.

Table 1. Performance specifications on the 10-watt, 5-tube power amplifier.

	10 w. (rated)	12-13 w. (max.)
Power Output:	10 w. (rated)	12-13 w. (max.)
Sensitivity:	600 mv. (at tone control input)	
Sensitivity (with feedback):	50 mv. (without tone control)	
Frequency Response:	10-20,000 cps	$\pm \frac{1}{2}$ db (at 1000 cps)
Maximum Power Output: (0 db = 10 watts)	+1 db at 40 to 10,000 cps 0 db at 20 and 16,000 cps -2 db at 15 and 30,000 cps	
Harmonic Distortion:	Less than .4% @ 10 w.	
Hum and Noise:	73 db below 10 w. 74 db below max. output of 12.5 w.	
Output Resistances:	.9 ohm on 15 ohm output	
Tone Control:	10 db boost in treble and bass 10 db attenuation (treble) 5 db attenuation (bass)	

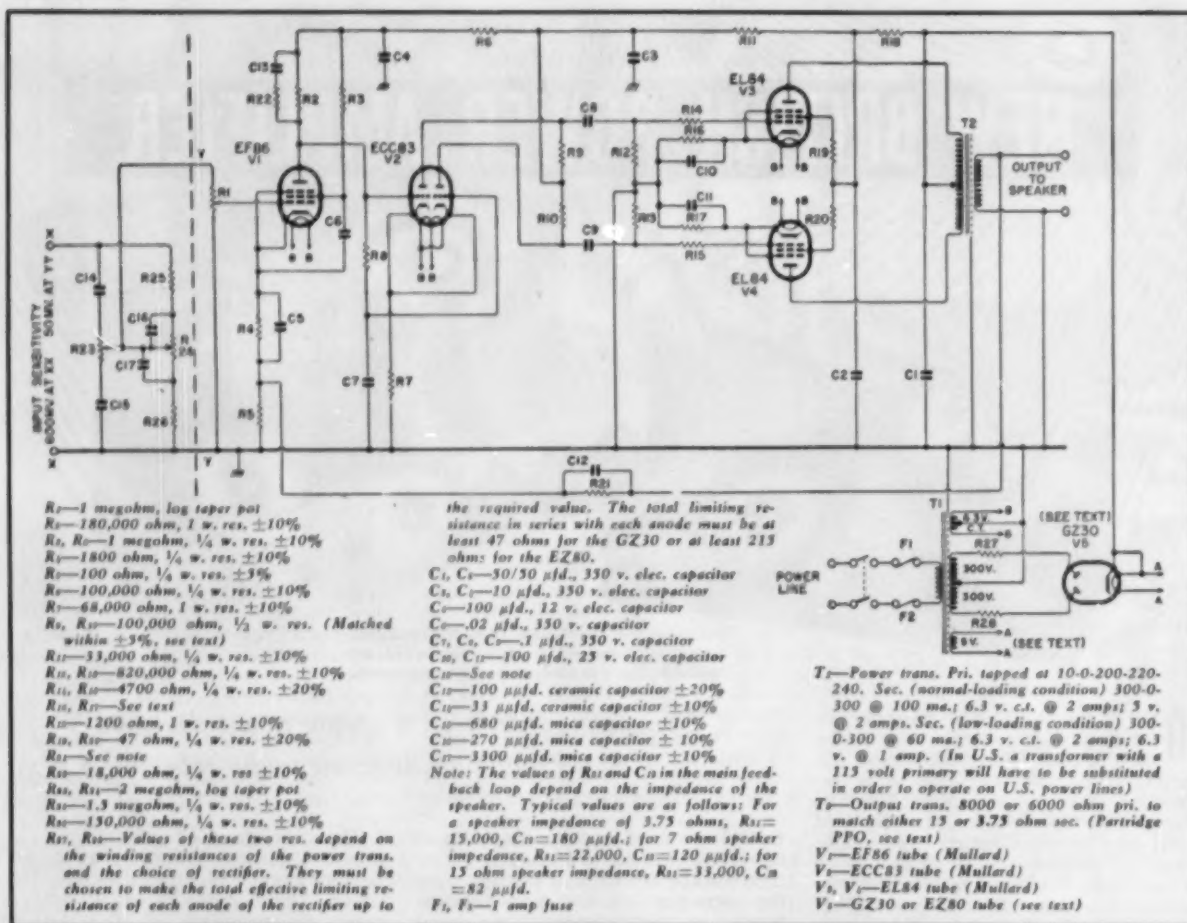


Fig. 1. Complete schematic diagram of the original Mullard-designed 10-watt amplifier utilizing British tubes and transformers.

The output stage is fed by an ECC83 double-diode operated as a cathode-coupled phase splitter. The two grids are coupled together by R_8 , the second being capacitively grounded by C_5 . The correct value of 1.5 v. grid-to-cathode bias is produced when the anode voltage of the EF86 is 70 volts. Anode resistors R_6 and R_7 (100,000 ohms) should be matched within $\pm 5\%$, R_7 being assigned the higher value of the two.

The use of the cathode-coupled circuit provides for low distortion and facilitates direct coupling to the first stage. The gain obtained with the cathode-coupled circuit is about half that obtained from each tube section operated as a normal voltage amplifier. However, the gain is sufficient as the ECC83 has an amplification factor of 100.

The output stage is equipped with two EL84 output pentodes operated in a self-biased, push-pull circuit. The anodes are fed from the electrolytic capacitor (C_1), the screen grids and the rest of the amplifier being supplied via R_{10} and C_6 . Separate bias resistors, R_{16} and R_{17} , are used. Resistors R_{19} , R_{20} , R_{21} and R_{22} are included in the control- and screen-grid leads to suppress oscillations.

Operating Conditions

Alternative modes of operating two EL84's in a push-pull output can be compared by referring to the curves showing total harmonic distortion plotted against output power, Fig. 3. Curve No. 2 is plotted for cathode bias and refers to a sine-wave input. It is obtained under the conditions given for class AB operation in the tube data tables. These conditions are necessary for testing the amplifier with a sine-wave input up to full power. They can be referred to as the "normal-loading" condition, the anode-to-anode impedance being 8000 ohms and the quiescent anode current 2×36 ma. With speech and music inputs, however, the output stage operates with approximately fixed bias. As a result, when the normal-loading conditions are used for speech and music (Curve No. 1), the distortion above 10 watts is considerably greater than might be expected from the data. It can be seen that above 12.5 watts the distortion for speech and music inputs would be nearly twice that obtained for a sine-wave input.

Low-Loading Operation

An alternative set of operating con-

ditions (Curve No. 3) will result in lower distortion when the amplifier is used for the reproduction of speech and music. Under these conditions, the anode-to-anode load is reduced to 6000 ohms and the quiescent anode current to 2×24 ma. This may be termed "low-loading" operation.

For low-loading operation, the appropriate value of both cathode resistors (R_{16} and R_{17}) is 437 ohms, made up of a 390-ohm and a 47-ohm resistor, as compared with the value of 270 ohms each for normal loading, i.e., for class AB conditions given in the data.

The high-voltage consumption is considerably reduced when the output stage is adjusted for low loading. As a result, the standing dissipation in the output stage is reduced from 11 watts at each anode to 7.5 watts, the output tubes then being run well below their maximum permissible anode dissipation of 12 watts. There will also be less ripple on the high-voltage line. As an economy measure, the power transformer can be given a lower rating provided the amplifier is to remain permanently adjusted to the low-loading condition.

Effective distortion for the low-loading adjustment cannot be measured

easily because standard measurements of harmonic distortion and intermodulation distortion are not practicable when the maximum output is approached. A low-level sine wave, however, may be used to measure frequency response providing that the output power does not exceed 1 to 1.5 watts, otherwise excessive distortion will occur. Normal square-wave testing can be undertaken, but the input should not exceed a level similar to that used for the low-level sine wave.

Peak Handling Capacity

Larger peak currents are produced in the output stage under low-loading conditions than with normal class AB operation. These peak currents are of short duration with a speech and music input. They are supplied by the electrolytic capacitor, C_1 , which is a 50 μ fd. unit.

As the current in the output stage increases, there follows an increase in the bias voltage across the cathode resistors at a rate determined by the time constant of the bias networks. Measurements have shown that, in practice, this increase in bias is not likely to exceed 1 volt. The working conditions of the output stage are such that the output tubes are then driven back into a region where lower distortion is obtained.

However, as a result of change in the bias of the output stage, a variation in gain will occur, but the distortion which is introduced in this way is held to a low level by the large amount of negative feedback.

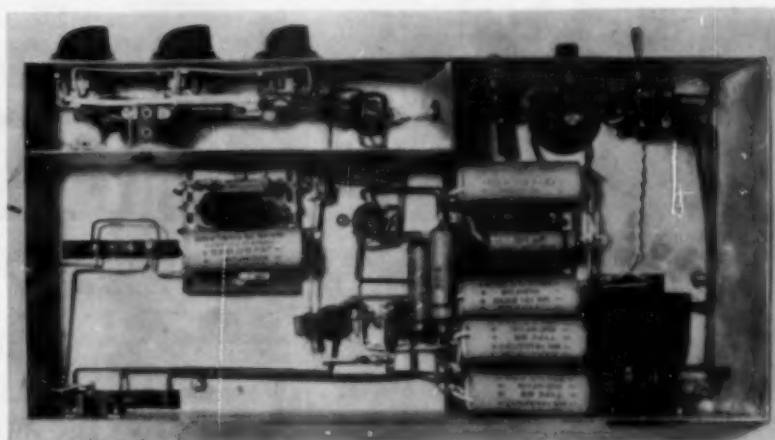
Output Transformer

Since the output transformer is the most important component in a feedback amplifier it is essential that it give adequate performance. The Partridge PPO used in this circuit was specially designed for this amplifier. Because of the "custom-built" nature of this transformer, it will obviously work better in this circuit than any other output transformer which might be substituted, although there are undoubtedly several U.S.-made units which could be adapted for this circuit. The Partridge transformer line is available in the United States and if you have any difficulty locating a source of supply, write to International Electronics Corp., 81 Spring St., New York 12, N. Y. for full details. The distortion curves of Fig. 5 were obtained with the prototype amplifier using this Partridge transformer.

Rectifier

The GZ30 full-wave rectifier can supply a current drain of 125 ma. and is entirely suitable for all applications of the amplifier. With the GZ30, sine-wave testing can be performed up to full output power. Under practical conditions, with speech and music inputs, the GZ30 will have sufficient current reserve to supply an FM tuner in conjunction with the amplifier.

The GZ30 has a 5-volt heater and is mounted on an octal base.



Underchassis view of the 5-tube, 10-watt amplifier built from Mullard specifications.

Since most home constructors do not have the necessary equipment to undertake sine-wave testing at high output powers, the company recommends the use of the EZ80 rectifier tube. The only restriction is that the EZ80 must not supply current in excess of 90 ma. Thus the EZ80 can be installed when the amplifier is to be permanently adjusted to "low-loading" conditions, discussed earlier, since sine-wave inputs can then be used to produce an output power of up to 1 to 1.5 watts. Under "normal-loading" conditions the power output can be increased up to 6 watts before overloading of the EZ80 will occur. Square-wave testing can be used with the EZ80 for both the normal-loading and low-loading adjustments, provided the input is of a similar level to that used for the corresponding sine-wave testing.

The EZ80 should not be expected to supply the additional current required for FM tuners and similar accessory equipment. The EZ80 has a 6.3-volt heater and is mounted on a noval base.

From the foregoing, it becomes obvious that the prospective builder must determine in advance how the amplifier is to be used since it will affect the selection of the rectifier tube to be used.

Since some readers will undoubtedly (Continued on page 132)

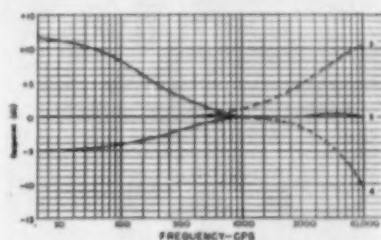


Fig. 2. Frequency response of the tone-control circuit. Curves 1 and 2 are maximum boost and cut of the bass control with treble set flat. Curves 3 and 4 are maximum boost and cut of the treble control with the bass set flat while Curve 5 is obtained by setting the bass and treble controls for flat response of the amplifier.

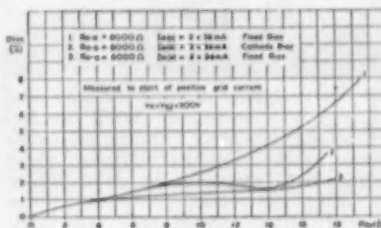
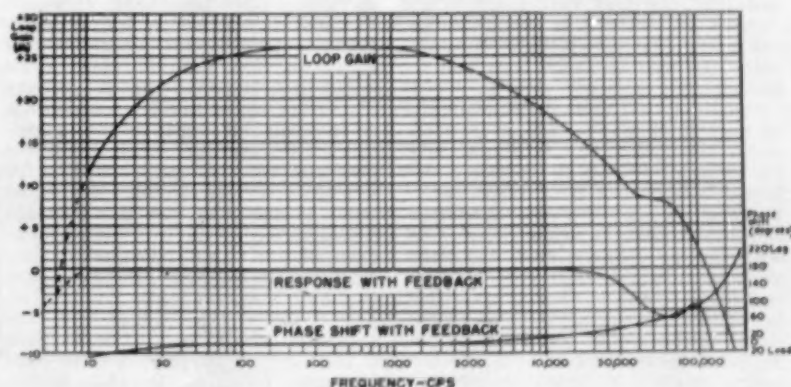


Fig. 3. Total harmonic distortion plotted against output power for two EL84's operated in push-pull, with anode and screen grid voltages of 300 volts. Refer to text.

Fig. 4. Typical phase shift and response characteristics of the complete amplifier.



DEVELOPMENTS IN U.H.F.

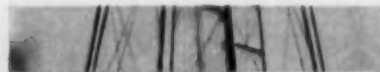
By

EDWARD M. NOLL

Here are some new ideas to help you lick your u.h.f. reception problems; also, new hope for u.h.f.'s future.



Receiving microwave dish antenna and high-gain channel 82 retransmitting antenna shown on a u.h.f. satellite station tower.



THE problems of u.h.f. foretell the path it is to follow. What are the problems of u.h.f.? There are three basic ones—coverage, economy, and sensitivity. Coverage improvement is a most important consideration in modern u.h.f. operations. Any step taken to improve coverage permits the serving of a greater populace with a more reliable signal. The economies of u.h.f. operation have been baffling in many areas because of the competition presented by strong v.h.f. signals and the fact that many u.h.f. stations are located in smaller cities where the capital wealth is substantially less than in large metropolitan areas.

Sensitivity has to do with the ability to make full use of whatever u.h.f. signal strength exists at the receiving location. Sensitivity is best interpreted in terms of signal-to-noise ratio. The over-all gain of a u.h.f. converter and a modern television receiver is adequate to amplify even the very weakest u.h.f. signal. The problem really is not one of lack of gain but rather of making the incoming u.h.f. signal dominate the inherent noise in the u.h.f. device. A typical u.h.f. converter employs a crystal mixer and

a rather narrow-band i.f. stage following the mixer. Consequently a very excellent signal-to-noise ratio can be established. Despite a good noise factor the u.h.f. signal is so weak in many areas and at some sites quite close to the transmitter, that it is not able to dominate the noise level.

It is apparent that the improvement in u.h.f. sensitivity must occur at some place between the antenna and the u.h.f. mixer. A stronger u.h.f. signal must be delivered to the u.h.f. device. At present, the use of u.h.f. radio frequency stages is too costly if the vacuum tube amplifier is to be designed with a noise factor better than that which can be attained with a crystal mixer. These factors stress the important contribution that the technician must make in obtaining better u.h.f. coverage. The u.h.f. antenna, transmission line, and installation are the key factors in the delivery of a stronger u.h.f. signal to the mixer.

Sensitivity Improvement

We have indicated in the previous paragraphs that u.h.f. reception would be improved most effectively if the signal level could be increased prior to its application to the mixer. In the receiver system there is sufficient amplification after the mixer. However, the major problem is to deliver a stronger initial u.h.f. signal to the converter so that inherent noise levels might be better surmounted. Delivery of a strong signal to the mixer depends on choosing the proper mounting position for the antenna, using an efficient high-gain antenna, and minimizing the loss of signal between the antenna and input to the u.h.f. device. A fourth consideration in the over-all performance of the u.h.f. converter is the crystal mixer itself as well as the local oscillator injection level. For best efficiency in a weak signal area, the technician should be certain to have a peak-performing crystal and local oscillator tube in the u.h.f. device.

Comparison can be made by substitution.

Using a higher gain u.h.f. antenna would be most helpful in raising the u.h.f. signal level of a particular installation. However, the u.h.f. corner reflectors and narrow-band yagis commonly used in low signal areas are already high-gain antenna types. The degree of elaboration necessary to obtain a substantial improvement over these types is prohibitive. In a practical sense, we have had more success with diversity arrangements of u.h.f. antennas.

In a typical diversity arrangement for the reception of a single weak u.h.f. channel, two narrow-band twelve-element yagis may be employed as shown in Fig. 1. Each yagi is positioned in a strong field. (Although this is a very important consideration, there is no definite equation that will permit you to calculate or estimate mounting positions for maximum signal. The procedure is entirely experimental.) After a strong signal position is found for each antenna, two separate lines are run down to the u.h.f. device. As is required for a good u.h.f. installation, the line (low-loss) should be run as direct as possible. The two lines are joined together at the input to the u.h.f. device. However, each line must be tuned for peak signals. To do this, proceed as follows:

1. Connect a transmission line from one of the u.h.f. antennas to the input of the u.h.f. device. Wrap a two-inch piece of aluminum foil around the line and slide the foil back along the line until a peak signal is obtained.
2. Touch the leads of the transmission line from the second antenna across the input terminals of the u.h.f. unit. Notice if there is an increase or decrease in signal level. If there is a decrease, reverse the leads. Fasten the leads beneath the input terminals.
3. Wrap a two-inch piece of foil around the second transmission line and move it for maximum signal. Re-adjust the foil on the first trans-

mission line slightly for maximum signal.

Another effective aid in improving u.h.f. reception is the positioning of the u.h.f. mixer at the antenna. The u.h.f. local oscillator may be located at the same point or down at the receiver. When the local oscillator is located indoors, near the receiver, it is not necessary to supply any power to the antenna-mounted u.h.f. mixer. The u.h.f. injection signal is sent up the transmission line from the local oscillator as shown in Fig. 2. The local oscillator signal mixes with the u.h.f. signal and sends a v.h.f. resultant down the line to the v.h.f. amplifier that is a part of most converters.

The antenna-mounted u.h.f. mixer eliminates the severe loss of u.h.f. signal strength that is caused by high line attenuation at u.h.f. frequencies. This arrangement is especially helpful when long lengths of line are required between the antenna and receiver. Additional improvement can be obtained by locating a high-gain, low-noise v.h.f. amplifier at the antenna to amplify the v.h.f. resultant before it is sent down the line.

U.H.F. Coverage

The reliable coverage area of u.h.f. stations is being extended with the increase in power output and proper location of the transmitting tower. A few stations with effective radiated powers of one million watts expect to be on the air shortly.

Although increasing the effective radiated power by using a high gain antenna is advantageous, it cannot be carried to the extreme. As the antenna gain is increased, the vertical radiation pattern is more and more confined. With too narrow a vertical radiation pattern it is possible to create pockets in the coverage area in which there is no signal or a very weak signal. Consequently, it is also important to increase the power output of the transmitter because in this way an increase in effective radiated power can be obtained without confining the radiation pattern too drastically.

Proper location for the transmitter site is very important. It is not always advisable to locate the transmitter too far from and too high above the populated area to be covered. In the desire to include more and more cities in the coverage range, the transmitter is often located at too great a distance from the major area to be served. This results in poor reception pockets in what is considered to be the primary coverage area for the station.

Transmitting antenna height is also important. It is conceivable that with too high an antenna location and too high an antenna gain, sections moderately near to the station will be without coverage.

The satellite and booster stations have proven encouraging in filling in pockets and extending coverage at reasonable cost. A booster station, as shown in Fig. 3, picks up the trans-

mitted signal from the main station at a point where the signal intensity is still very high. The booster can be located on a mountain top near the poor reception pocket or near the distant city to be covered. The received signal is amplified and then re-radiated on the same frequency by a low-powered transmitter. The booster transmitting antenna is made highly directional to concentrate the re-radiated signal into the poor reception pocket. Because the high-gain antennas at the booster station are highly directional, there is a minimum of interference between the direct signal and the re-radiated one.

A successful installation of a booster station was made by RCA to supply Vicksburg, Mississippi with a satisfactory u.h.f. signal from Jackson, Mississippi, some 35 miles away. Vicksburg, which is shadowed by a ridge, had not been able to receive satisfactory signals from the 17,000 watt transmitter at Jackson. The high gain receiving antenna, mounted on a water tower, as shown in Fig. 4, picks up the channel 25 u.h.f. signal from Jackson and applies it to a booster amplifier.

The gain of the booster is approximately 100 db with a bandwidth essentially flat over 6 megacycles. The output of the booster supplies signal to the highly directional booster antenna that directs the channel 25 signal into the Vicksburg area. To minimize interference between the two antenna systems and signals, the antennas are designed with high gain and ideal patterns.

Another method that can be employed to minimize interference between two signals on the same frequency is to change the signal polarization. For example, it is possible in a booster operation to receive a horizontally polarized signal from the main station and apply the booster amplifier output to a vertically polarized transmitting antenna. In this arrangement, the receiving antennas in the poor reception pocket area must be vertically polarized.

Economics of U.H.F.

The economic problems of u.h.f. have been trying. Most allocations have been to small cities which have limited sources for station revenues. In many areas the u.h.f. station has to compete with a local v.h.f. station or with a v.h.f. fringe station that delivers adequate signals to the area. The growth

Fig. 1. Diversity reception setup for using two u.h.f. antennas with one converter or tuner. The small 2" aluminum stubs are used to maximize the signal.

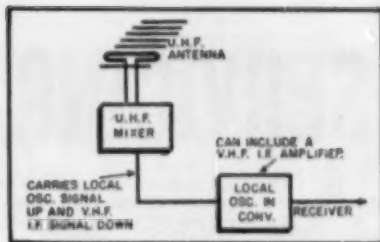
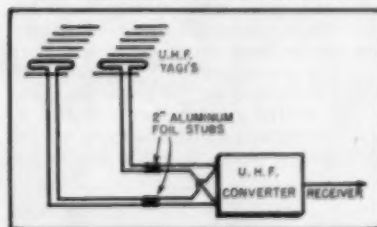


Fig. 2. Mounting the mixer stage of a u.h.f. converter or tuner on the antenna mast minimizes the loss of signal in the transmission line. This loss is much greater for u.h.f. than for v.h.f.

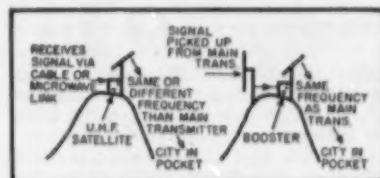


Fig. 3. Satellite and booster stations are used as shown here to fill in pockets of poor or no reception within the transmitter coverage area. The booster rebroadcasts on the same frequency as that of the original signal; the satellite station may broadcast on another.

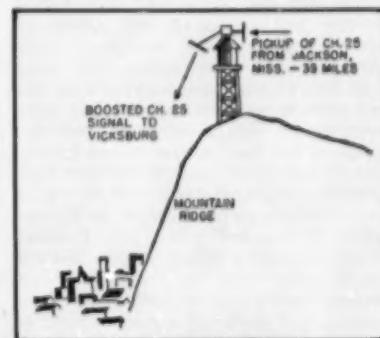


Fig. 4. A booster station located on a water tower near Vicksburg, Mississippi, fills in the channel 25 coverage area.

of u.h.f. is further hampered by limited coverage and the fact that an investment is required on the part of the viewer to add u.h.f. reception to his receiver. The additional equipment needed to extend coverage and increase power is a further burden on the u.h.f. station.

In a number of locations local u.h.f. stations have suffered because of competition from community wired-television systems.

Certainly u.h.f. is here to stay. It delivers, and will continue to deliver, reliable service within its coverage limitations. We can expect to find continued developments both in transmitting and receiving methods to improve reception conditions within the projected service areas of u.h.f. stations. However, the rate of growth and the total number of u.h.f. stations to come on the air must now be estimated more conservatively because of the problems discussed here.

SERVICING COLOR TV

Fig. 1. A color-bar generator is probably the handiest color test instrument. A typical one is the RCA generator shown here.



By MILTON S. KIVER*

Part 3. Concluding article covers the sources and cures for incorrect color rendition and instability.

A COMMON ailment of color television reception is incorrect color rendition, i.e., color is present in the picture, but the hue is not what it should be.

One of the first things to check when the foregoing complaint is heard, is the hue control. (Sometimes this is called the color fidelity control.) This is either mounted on the front panel of the set or accessible from the front by lifting a small metal plate. Rotation of this control will have a marked effect on the colors observed on the screen. Red may change to yellow, green to blue, and blue to magenta or red. Circuitwise, the control may be located directly in the oscillator circuit, where it deals with the phase of the oscillator voltage, or it may affect the 3.58-mc. color burst which is used by the phase detector to establish the frequency and phase of the generated 3.58-mc. subcarrier voltage. Both methods have been employed to date.

If the various color circuits in the receiver are functioning normally, then some point should be found over the range of the hue control where the observed colors possess the proper hue. Probably the best reference to use is the color of a person's skin. In the absence of this reference, any familiar object, such as a yellow banana or a red apple, etc., may be employed. Of course, errors can be made here in assuming the shade of a color which, in actuality, may not be true.

The best solution, and one which will undoubtedly be used the most, is to substitute the signal from a color-bar generator for the transmitter signal. The colors then produced on the screen will be definitely known and any necessary adjustment can be made accordingly.

The color-bar generator is almost a necessity for any amount of color servicing. This is an instrument which develops a number of bars, each of which has a specific color. Some units, such as the RCA generator shown in Fig. 1, cause all of the different color bars to appear on the screen at the same time. See Fig. 2. From left to right, the bars are as follows: dull yellow orange, orange (+I), bright red (+R-Y), bluish red, magenta (+Q), blue (+B-Y), greenish blue, cyan (-I), bright bluish green -(R-Y), and dark green. Other color-bar generators present only one or two different colors at a time, additional colors being brought onto the screen by rotating appropriate instrument controls. Each color is identified on the color dial so that the technician knows what they

should be and hence knows what to look for on the screen.

With a color-bar generator, it takes but a minute to determine whether or not the set is producing the correct colors. The hue control on the receiver is rotated until the colors on the screen assume their proper hue. If this condition is obtainable, then we know that the set control was misadjusted. However, if no position of the control knob will produce the proper colors, then further trouble is indicated. Let us investigate the most probable sources for trouble that would result in incorrect color rendition on the screen.

The color in the picture developed on the screen of a color television receiver is the responsibility of the color sync section, the chrominance section, and the color burst reference of the incoming signal. All the other sections beyond the video second detector can be checked by observing the monochrome portion of the color signal on the screen. This was indicated in Parts 1 and 2 of this series and is also the reason why the picture is observed first in black-and-white. With this in mind, let us see what the effect would be of various difficulties in the color sync and chrominance sections.

In the color sync section we have the burst amplifier plus whatever method is used to generate the 3.58-mc. subcarrier and to synchronize its phase with that of the incoming color burst. In the system shown in Fig. 4, the oscillator is continuously in operation and a phase detector and a re-

actance tube are employed to keep the oscillator frequency in step with that of the color burst. A hue or color phase control permits variation of the oscillator phasing and the check on this control has already been mentioned. A defective reactance tube would lead to the loss of color synchronization with the visual result that the colors would keep shifting. Under these conditions, too, rotating the color phase control would have no effect on the colors in the picture. This is because, in this circuit, any change brought on by the control could not reach the oscillator because of the intervening defective reactance tube circuit.

Another cause for the appearance of the wrong colors on the screen could be trouble (a defect or misalignment) in the quadrature amplifier output transformer shown in Fig. 4. This transformer is normally set up to provide the Q demodulator with 3.58-mc. subcarrier voltage which is 90° out-of-phase with the I demodulator. Any departure from this 90° (or quadrature) relationship will lead to incorrect color rendition.

There is another difficulty that can develop in the quadrature transformer, but to appreciate its significance we require the presence of a color phase diagram. See Fig. 3. Here we see the phase relationships between the various colors, together with the relative positions of the I, Q, R-Y, and B-Y vectors and the color burst. Now, as we examine this diagram, we see that there is a positive I and a positive Q as well as the negative I and a negative Q. The positive I and Q vectors are 90° out-of-phase with each other; the same is true of the negative I and Q

*Author of "Television Simplified," "Television and FM Receiver Servicing," and other books.

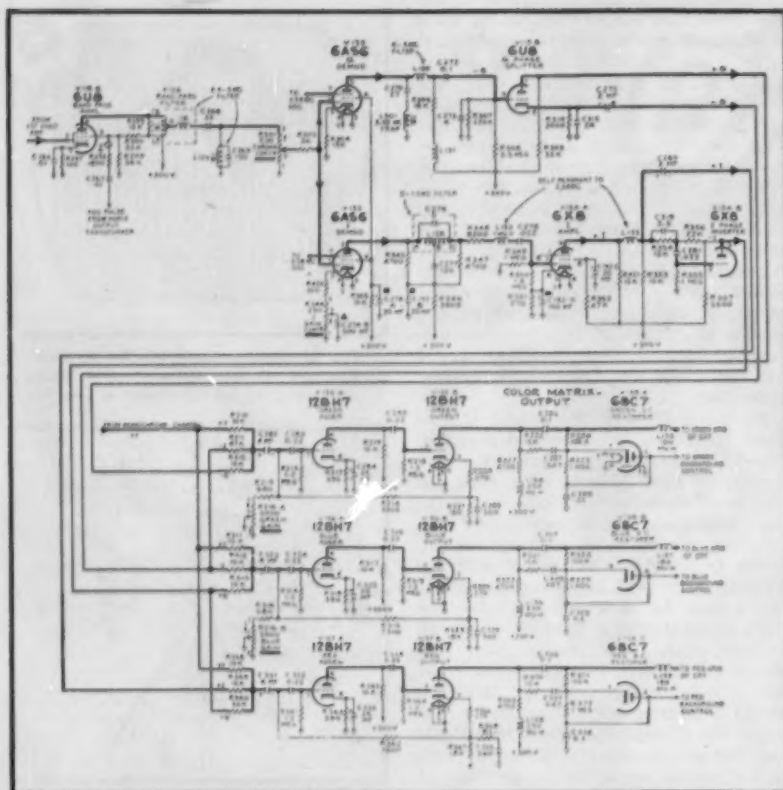


Fig. 5. Schematic diagram of the chrominance circuits of an RCA CT-100 color set.

the formation of the green color since green is formed by combining $R-Y$ and $B-Y$ according to the equation:

$$-(G-Y) = .51 (R-Y) + .19 (B-Y).$$

A missing $R-Y$ or $B-Y$ component would alter the final value of G and cause its appearance on the screen to be incorrect.

While the color sync and chrominance stages are the major sources of trouble when the color shading is incorrect, still other sections of the receiver may also be responsible. In the r.f. and i.f. stages, for example, poor alignment, particularly in the region occupied by the color signal, can lead to incorrect color on the screen. Of course, if the color burst itself is affected, then the color may disappear completely. This we have already noted.

Probably the best way of isolating such trouble is again by use of the color-bar generator. Apply the unmodulated signal at the video second detector, and observe the colors of the bars in the resulting pattern. Then modulate the signal and inject it at the antenna terminals. Again observe

the pattern produced. If the colors are true on the first test, but altered in hue on the second test, trouble is indicated ahead of the detector. The best check to make then would be to observe the response pattern, both r.f. and i.f. Pay particular attention to the portion of the response which deals with the color signal sidebands.

The Delay Line

If the delay line in the Y channel does not introduce the proper amount of delay in the Y signal, the color rendition will be affected. To appreciate the visible consequence of this action, let us briefly review the part played by the Y signal in the over-all formation of the color picture.

The Y signal contains all of the video frequencies displayed in the picture. In the absence of color, perhaps due to a defective color section in a receiver or because the program is in black-and-white, a full black-and-white picture is obtained.

Now, to obtain a color picture, three pieces of information are required. First, there is the color or hue itself, be it green, blue, red, yellow, etc. Second, there is the saturation or the intensity of the particular color; and third, is its brightness. The first two components are carried by the color sidebands; the remaining item, brightness, is the information that the Y signal possesses.

With this in mind, let us examine some common colors to see how much

of their total make-up is formed by the brightness component. In Fig. 6 we have a series of six colors: red, yellow, green, cyan, blue, and magenta. To ascertain their brightness values, we require the formula for the brightness signal, namely,

$$Y = .59G + .30R + .11B.$$

From this equation, we see that green has a brightness value of 59 per-cent, red a value of 30 per-cent and blue, 11 per-cent. Yellow and cyan are not given directly because they are combination colors. To arrive at their brightness values, we must add the brightness values of their components. Since yellow is formed from red and green, its brightness value is .59 plus .30 or .89. By the same reasoning, cyan has a brightness value of .70 and magenta a value of .41.

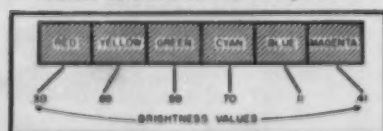
Of the six colors, yellow has the highest brightness value and blue the lowest value. On a screen, then, yellow will appear brightest and blue will be the darkest. However, if something should cause the Y component to disappear, perhaps by a defect in the Y channel, then the yellow would become quite dark. Cyan, which contained 70 per-cent brightness would become darker, although not as much as yellow. Green would lose even less brightness, red still less, and blue practically none at all since it possessed only 11 per-cent to start with. Thus, with the complete loss of brightness, the apparent intensity of the colors appearing on a screen would reverse, with the brightest colors (ordinarily) appearing darkest and the darkest colors appearing brightest. If you come across a situation like this, you can check for the brightness component by observing the picture in black-and-white. (This can be accomplished most easily by turning the chroma control to its extreme counterclockwise position). What you see on the screen should either be a very dim picture, just barely visible, or no picture at all.

Instead of the complete loss of the Y signal, we might encounter a situation in which the delay line in the Y channel did not introduce sufficient delay. This would occur if part or all of the line shorted out. Under these conditions, the Y signal would appear at the matrix before its corresponding color component. As a result, the Y component will combine with some other, prior color. If we had the color-bar pattern of Fig. 6 on the screen, part of the red bar would possess its proper brightness and part would be lighter in appearance because the higher brightness component of the yellow would now be mixing with the red. In the yellow bar, the first part would be normal, but the second half would be darker (although still yellow, of course) because it would be combining with the lower brightness component of the green bar. The same thing would occur all along the line.

On a completely black-and-white picture, a defect in the delay line

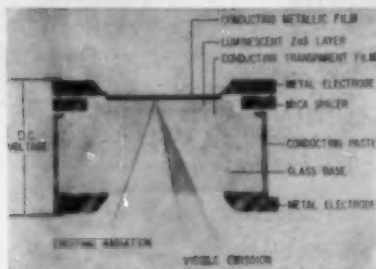
(Continued on page 126)

Fig. 6. Six saturated colors are represented here with their brightness values obtained from the Y equation.



LIGHT AMPLIFIER

A LONG-SOUGHT SCIENTIFIC GOAL



Elements of the special phosphor cell developed by scientists at G-E to achieve direct amplification of light, without tubes.

MANY exciting possibilities are envisioned as the result of a recent demonstration of General Electric's new "light amplifier," a unit which amplifies light without the use of electronic tubes.

Although this discovery may be the clue to achieving "picture-on-the-wall" television screens, and to advancing the art of x-ray fluoroscopy, photography, "seeing-in-the-dark" devices, and other developments involving reproduction of picture images, the company is cautious about predicting any immediate application of this technique.

Interest in this phenomenon lay not so much in its immediate use but in the fact that scientists are now able to increase the brightness of a projected photograph by passing an electric current through a special phosphor cell



Dr. F. E. Williams (right) and D. A. Cusano demonstrate the amplification of light.

"Picture-on-the-wall" television, improved x-ray techniques, etc. are much closer to reality—thanks to G-E scientists.

which is used as the viewing screen.

In the demonstration an ordinary lantern slide projector was employed and the picture was a regular photo-slide. The small screen produced a yellowish image when an ultraviolet light source was used in the projector. As the voltage on the specially prepared screen was increased, the picture became bright in the manner usually achieved either by increasing the intensity of the projector light or by opening the lens aperture. Neither the light nor the lens was altered, however, and the picture—which was first barely visible—became many times brighter and clearer.

The demonstration further revealed that applying an electric voltage does not of itself cause the special phosphor screen to give off light. Ultraviolet energy falling on the screen causes a

faint glow, but there is no amplification. Amplification occurs only with voltage and the ultraviolet.

Proof of true amplification is obtained by measuring the number of photons of light striking the screen and comparing this with the number given off. Increases of at least ten times have been measured and the company believes much higher ratios are possible. Because the amount of light produced is proportional to that striking the surface, it is possible to brighten intermediate shades of the picture being projected, making a brighter picture without "washing out" contrast.

The new light-amplifying phosphor, the basis of the light amplifier, was a development of D. A. Cusano, a young General Electric scientist who conducted the demonstration. —30—

Two photographs printed simultaneously from negatives made consecutively on a roll of 35 mm film. The increase in brightness visible in the photograph at the left is due entirely to the light amplification technique which involves a combination of ultraviolet light, a special phosphor, and the application of a voltage to the phosphor to give a light increase of ten times.



Not much has been published to date on the idea of using a wall screen for direct viewing in place of our conventional picture tubes. Many major electronic companies are at the present time working on the idea which will, no doubt, become a reality in the future. This new light amplifier may be a clue to "picture-on-the-wall" developments, according to G-E.



"YOU'RE sure you won't have to take my television set away from the house?" asked the lady over the phone. "My favorite programs are tonight and I don't want to miss them." The girl at the *Mobile TV Company* office in Tempe, Arizona, assured the customer she wouldn't miss a single minute of evening programming if the *Mobile TV* truck called that afternoon.

"That's the big reason for our success," explains Dick Ramos, owner of the company. "People don't want their TV sets taken from their homes. They don't want to miss their favorite programs, and they are worried that their sets may be scratched or otherwise damaged by moving them."

To accommodate his customers, Ramos has equipped a truck as a complete TV repair shop on wheels. A workbench, a stock of 1100 tubes, a dozen test instruments, and associated equipment are included in the truck. In 98 per-cent of his calls, Ramos is able to correct the trouble in one trip, thus eliminating expensive callbacks that inconvenience the customer and cut into the profit of the service operator.

Mobile TV has a shop and office in downtown Tempe, where telephone calls and customer drop-ins are handled by an office girl who has become sufficiently conversant with television servicing problems to discuss the customer's problem intelligently.

"It isn't necessary to hire a highly trained television repairman for the downtown office," Ramos explains. "In a short time an intelligent office girl will know more about a television set than 95 per-cent of the customers she deals with. Her main function is to meet the customer, in person or via telephone, pleasantly and in a helpful manner. In most cases she passes the technical problems on to me or my assistant."

How the girl relays messages to Ramos in the truck points up another factor in the firm's success. Because *Mobile TV's* plan of operation is based on quick service calls and maximum utilization of the technician's time for technical problems, Ramos wanted to reduce the time between calls. First he installed two-way radio communication between the truck and shop in an effort to get the address of the next stop as quickly as possible. The system worked well enough, but it involved tying up considerable money in radio equipment and presented certain operational and maintenance problems. So Ramos changed to radio paging, a system which costs less than one fourth that of two-way radio.

The *Central Alarm Company* of Phoenix offers a u.h.f. radio paging service in which the subscriber listens in periodically on a tiny receiver for calls. The *Central Alarm* operator records the calls, seldom more than five words long, and puts them on the air in sequence. Thus, by listening for 30 seconds or so, the subscriber can determine if he has a call.

Ramos keeps the truck on a special



By DEAN SMITH

How far should you go in catering to your service customers? Here's one answer that has paid off.

driveway at the rear of his home and goes to the shop only twice a day to check his service calls against the office girl's list, and to handle buying and management functions.

One TV service firm in the Phoenix area bases its advertising on the assumption that no TV repair job can be as effective as one done in the firm's downtown repair shop. Ramos disagrees and has sound reasoning behind him.

In the first place, he says, the *Mobile TV* method eliminates the necessity of transporting the customer's set several blocks or miles. In most cases the repair is done in the customer's own living room. In the others, the set is taken only as far as the truck workshop, parked in the driveway.

In the second place, repairing the set at the customer's home allows actual operating conditions to be maintained during trouble diagnosis and during post-repair testing. A set may be made to work admirably in a repair shop and still fail under the operating conditions of the customer's home. Antenna characteristics, local interference problems, etc., can thus be taken care of in a *Mobile TV* repair job.

Finally, the *Mobile TV* method builds customer confidence. He can watch for himself every operation performed by the service technician and see that he is paying only for work accomplished and parts replaced. Ramos encourages customers to come out to the truck for a look at the completeness of his shop on wheels. Most customers are genuinely impressed.

Ramos' plan of operation works like this: At 9 a.m. he drives the truck by his assistant's home and they start on service calls left over from the previous day, keeping in touch with the office via radio paging for other calls. At the customer's home, Ramos goes inside and makes an analysis of the trouble while the assistant cleans up the workbench, checks tube stocks, etc. If the set is brought to the truck

for checking, both men work on it in the mobile workshop.

Mobile TV plugs into the customer's power supply, thus removing the necessity of carrying a portable power unit. Only two or three customers have ever complained about his using their electricity and they were placated when Ramos answered jokingly that he would subtract 25 cents from their bill to take care of the power used.

In the truck Ramos carries the following equipment: AM and FM signal generators, AM marker and sweep generator, a 5-inch oscilloscope, vacuum-tube voltohmmeter, portable voltohmmeter, flyback transformer checker, capacitor checker, synchro sweep generator, vertical and horizontal pattern generator, substitution tester, portable high voltage tester, portable a.c. autotransformer, and an isolation transformer. A ladder and antenna are mounted atop the truck.

To make the technician's job more comfortable, Ramos has installed an evaporative air cooler in the front of the truck. On summer days it can be plugged into the customer's power source and the truck is kept comfortably cool.

Inside the truck are carefully designed shelves and bins for test equipment and parts. A metal-covered workbench is coupled to a metal shelf. The workbench measures 2½ feet by 3½ feet, and sufficient clearance is allowed between it and the shelf above to allow a 21-inch chassis to be placed thereon.

Ramos has redesigned the truck interior several times, learning from experience better methods for utilizing the limited inside space.

He does not attempt to transport every tube he might need, but the 1100 he carries take care of nearly 90 per-cent of his tube changes. He carries only three cathode-ray tubes: 16-inch, 17-inch, and 21-inch. When a different cathode-ray tube is needed, Ramos utilizes an arrangement made some



time ago with his tube wholesaler in Phoenix. A telephone call will bring a truck from the wholesaler to Tempe or to the customer's home, whichever is closer.

To compensate for long service trips, Ramos adds \$1.00 to the service charge for all calls farther than five miles from his shop. He will not accept calls beyond designated limits, roughly 15 minutes driving time from the shop. He believes that longer trips would take up so much time and boost truck expense so much that the customer would not accept the higher charges involved.

"A mobile service such as ours can make a small repair shop much more profitable, if certain conditions are fulfilled," Ramos points out. "You must have better than average technicians operating such a truck or you lose money. The trouble diagnosis must be fast and sure, and the repair accomplished in a minimum of time. A slow workman will tie up a truck and a helper in our setup. In a conventional setup he can delay nobody but himself. Another thing, if the technician fails to nail the trouble on the first call, a second one is required and that often eats up all the profit on the transaction."

Eying the large and complex color TV receivers now commercially available, Ramos feels that the advantages of his type of operation are even more apparent. Servicing these large single or multiple chassis affairs in the home, or even wheeling them into the truck close at hand, will save a considerable amount of time plus untold wear and tear on the technician. The amount and type of TV service work that will be necessary on color TV receivers in the years ahead is largely a question mark in the minds of most service

operators. A flexible operation, such as Ramos' is in an excellent position to forge ahead with a minimum of displacement.

The imposing array of test instruments lining the shelves of the Mobile service truck is not the only indication customers obtain of the completeness of the service facilities available to them from this unique outfit. A complete service publication file, constantly kept up-to-date, is dog-eared through use on the various service

jobs performed. Most of this information is kept in a metal file cabinet next to the service bench for easy access.

Mobile TV, like any similar service company operating on the basis of repair in the home, is in an excellent position to solicit and obtain service income from the repair of radios, phonos, and similar items which have been lying around the house because they are in need of repair. Many times, the customer will dig up these "old friends" and bring them out to the truck to see whether "the service technician thinks they are worth repairing." In most cases they are, and the fact that the service truck is already on location makes this type of service extremely profitable.

Just how effective the bright colors on the truck are as far as advertising is concerned is hard to tell, but it certainly makes for pleasant working surroundings.

Ramos believes that a mobile service will work at maximum efficiency only in a small shop. One man and a helper, with a girl in the office, is the ideal situation, he says.

Ramos first utilized his idea in 1948 in Frankfort, Indiana, where he started a mobile radio repair service with a GMC carry-all and considerably less equipment than he now carries. It was not particularly successful. "The public was reluctant to pay what the service was worth," he explains. "They saw us working 15 minutes on a \$30 set and felt that it was worth only a couple of dollars. In TV work, however, customers are more willing to pay what the service is worth, and they appreciate the fact that we don't take the set away from the house."

-30-



A view of the interior of the truck showing the test equipment available and the storage shelves for the tube and parts stock. The workbench will hold one TV chassis at a time, which is actually all that is required on a single service call.



THE AUDIO SQUELCHER



Front view of the audio squelch. The use of decals lends a "professional" touch.

By

DON M. WHERRY, W6EUM

Construction details on a simple combination limiter and squelch circuit for the audio output of a ham receiver.

SQUELCH circuits have been in use for a number of years but for some reason are relatively unknown to the amateur fraternity. The reason may be due to their complexity rather than to their lack of value. For some time it has appeared to this writer that some simple means of eliminating background noise and signals, which are of a lower order of amplitude than that of the desired signal, would be of considerable value. This is particularly true of the traffic net and the casual "rag chewer" operator, who are not, as a rule, digging down into the background noise for a signal. Such a circuit would also have applications in the "call or alarm" fields. The receiver could be tuned to the net frequency and the background squelched out leaving a silent output until the control station opens up, for instance. In case you are CD minded,

such a device could be installed in a simple receiver and left tuned to your local CD channel for continuous, silent monitoring.

With the objective of such a unit in view the following instrument was constructed.

A quick glance at Fig. 2 indicates that the circuit consists of an amplifier, the grid bias of which is controlled by a keyer tube, followed by an overdriven amplifier. The entire unit was made independent of the receiver by the addition of its own power supply.

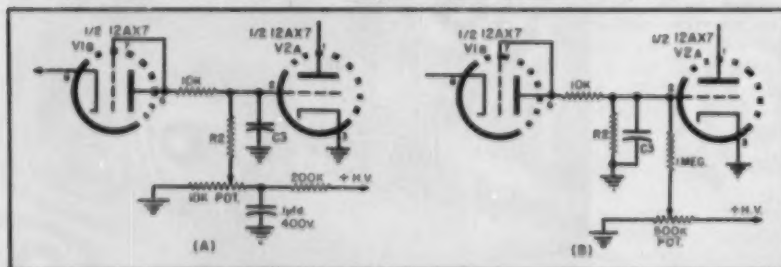
An analysis of the circuit shows the input derives its signal from the phone output, or any convenient a.f. point in your existing communications receiver. This signal is then diverted into two channels, one to a rectifier and the other into the controlled amplifier grid.

The rectifier channel uses one crys-

tal diode, 1N34, and one-half of a 12AX7, for the rectifier. This was done only because one-half of the tube was available. Two crystals would be equally satisfactory. The rectified output is then filtered by R_2 and C_3 and impressed on the grid of the keyer tube, V_{2A} . One point should be noted, the value of C_3 is rather important. Too large a capacity will introduce a lag into the "open time" of the keyed tube, which is undesirable, showing up as a delayed opening and closing of the amplifier. On the other hand too small a capacity will allow noise peaks of high amplitude but short duration, such as auto ignition, to trigger the tube. The value shown is the best compromise. The impressed voltage on the grid of V_{2A} , which is proportional to the audio output level of the receiver, is then used to trigger the keyer tube. In other words, the keyer tube, which is running with zero bias with no input signal present, is cut off when a signal of sufficient amplitude is applied.

Returning to the alternate channel, the signal from the receiver is fed directly into the grid of an audio amplifier, V_{1A} , the ground point of which is the junction of the two resistors R_2 and R_3 . With no signal present it can be seen that V_{1A} is cut off because of the voltage drop across R_2 which, in turn, is caused by no bias on the grid of V_{1A} and the subsequent plate current flow through R_3 . Conversely, with a signal present from the receiver, V_{2A} is cut off, removing the drop across R_2 and converting V_{1A} to a straight audio amplifier. In practice some method of

Fig. 1. Two alternate methods of setting the squelch threshold voltage. See text.



preventing the background noise from opening the gate tube and thereby defeating the unit's purpose must be employed. This is accomplished by R_7 which moves the cathode of V_{s4} below ground an amount necessary to insure the grid being above cut-off, thereby silencing V_{s4} . In case that is somewhat confusing let us take an example. Assume that the background, QRN etc., puts a voltage of one volt minus at the grid of V_{s4} . This will cut off this tube and allow the noise to go on through V_{s4} unhindered, in fact amplified. Now if we make the cathode of V_{s4} minus by one volt with respect to the ground the net bias of the tube will be zero and its plate current through R_5 will drop the grid of V_{s4} below cut-off and effectively "squell" the noise from the output. If a signal of one volt above this noise is then added, the grid of V_{s4} will go minus by one volt with respect to its cathode, thereby cutting off the plate current and opening V_{s4} for normal amplification. These voltage figures, while illustrating the action, are arbitrarily taken.

The output of the squelch tube is then fed to the grid of the overdriven amplifier which acts, in this application, as a limiter or clipper tube. This function it performs very well (Fig. 3), in some ways superior to the more usual biased diodes. The action of this tube is as follows. With the application of a signal the tube draws grid current, due to no cathode bias, and as a result builds up a negative charge across R_6 . This bias limits the positive portion of the output waveform quite sharply. The negative portion of the output is limited in two ways; first, due to the already mentioned grid current flow, and second, due to low plate voltage applied to the tube by R_{11} which causes plate saturation. As the cut-off point of a triode is dependent on the plate voltage this controls the limits of both the positive and negative peaks of the output signal. This method has less of the characteristic blocking action when overloaded by a loud signal than the diode method and, in addition, has the twin advantage of having a readily adjusted clipping level and showing an amplification factor at signal levels below the clipping point.

The power supply is the usual half-wave type with an RC filter. The large amount of capacity was used to insure hum free operation in the absence of a filter choke.

The unit was constructed in a 5x4x3 inch chassis but it is the advice of the writer to use a larger one unless you are endowed with an abundance of patience. The two controls are the clipping level, on the left, and the threshold level on the right. The top of the chassis shows the two 12AX7 tubes and the dual filter capacitor.

It is the firm conviction of this writer, based on thirty years of ham experience, that no one ever builds anything "just like the article," and in this case it is suggested that free

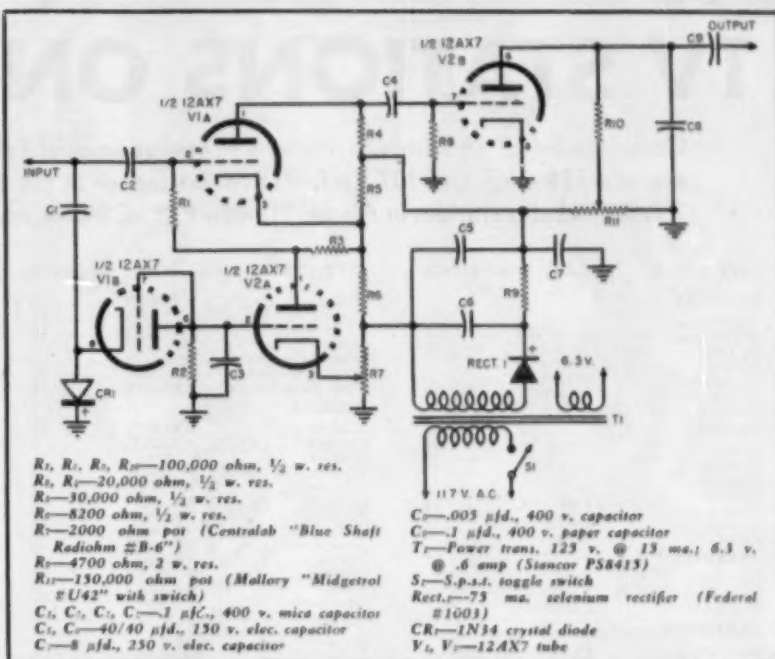


Fig. 2. Complete schematic diagram of the audio squelch. See Fig. 1 for variations.

rein be allowed the builder as the unit described is in no way represented as the "ultimate." For example, a different method of biasing V_{s4} as shown in Fig. 1, might have advantages over the one used, the gated-beam 6BN6 might make a better keyer tube than V_{s4} , etc.

As it stands, however, this unit makes a good accessory to the ham station. In operation at this station the receiver gain is set at approximately the "normal" position and the squelch threshold adjusted until the noise, with no signal present, just barely drops out. While in that condition any signal above the noise level will trigger the output. It is also possible to squelch out QRM, if it is not too strong, leaving your signal standing out alone. Of course during the time your signal holds the amplifier open

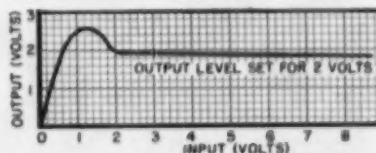
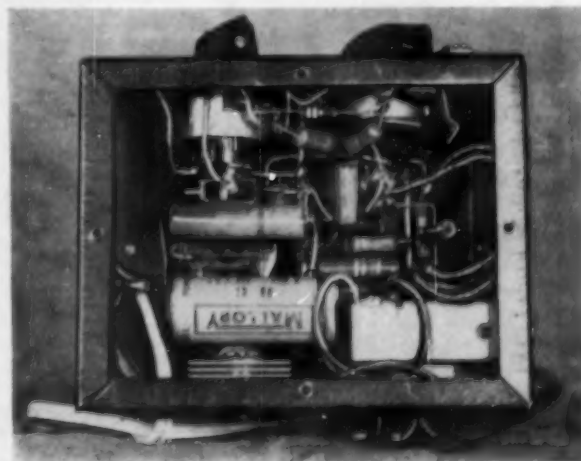


Fig. 3. Limiter characteristics of unit.

the QRM is also present but as it is being keyed with the signal you are reading it causes no trouble. If the squelch is not desired the control R_7 will cut it out entirely, and the unit then operates as a straight audio amplifier allowing the r.f. gain of your receiver to be backed off. The clipper also can be used, or not, by the setting of R_{11} . In any event the cost of construction is small, and the effort smaller, so why not try it? —50—

Underchassis view of unit shows the power transformer in lower right hand corner with rectifier and capacitor to left. The author recommends use of a larger chassis for less work.



TV STATIONS ON THE AIR

Complete list of all television stations in operation as of February 25th, 1955. There are now 128 u.h.f. and 307 v.h.f. stations on the air in the continental United States. This list includes stations in Alaska, Hawaii, P. R., Canada, and Mexican border stations.

CITY, STATE	CALL	CHANNEL	CITY, STATE	CALL	CHANNEL	CITY, STATE	CALL	CHANNEL
ALABAMA			Pensacola	WEAR-TV	3	Lake Charles	KTAG	25
Birmingham	WABT	13	Pensacola	WPFA-TV	15	Monroe	KNOE-TV	8
Birmingham	WBRC-TV	6	St. Petersburg	WSUN-TV	30	New Orleans	WDSU-TV	6
Decatur	WMSL-TV	23	Tampa	WFLA-TV	8	New Orleans	WJMR-TV	61
Mobile	WALA-TV	10	West Palm Beach	WEAT-TV	12	Shreveport	KSLS	12
Montgomery	WCOV-TV	20	West Palm Beach	WIRK-TV	21			
Montgomery	WSEA-TV	12	West Palm Beach	WJNO-TV	5			
Munford	WEDM-TV	7				MAINE		
ARIZONA			GEORGIA			Bangor	WABI-TV	5
Mesa	KVAR	12	Albany	WALB-TV	10	Bangor	WTWO	2
Phoenix	KOOL-TV	10	Atlanta	WAGA-TV	5	Lewiston	WLAM-TV	17
Phoenix	KPHO-TV	5	Atlanta	WLWA	11	Poland	WMTW	6
Phoenix	KTVK	3	Atlanta	WQXI-TV	36	Portland	WCSH-TV	6
Tucson	KOPO-TV	13	Atlanta	WSB-TV	2	Portland	WGAN-TV	13
Tucson	KVOA-TV	4	Augusta	WJBF-TV	6			
Yuma	KIVA	11	Augusta	WRDW-TV	12	MARYLAND		
ARKANSAS			Augusta	WRDK-TV	28	Baltimore	WAAM	13
Fort Smith	KFSA-TV	22	Columbus	WRBL-TV	4	Baltimore	WBAL-TV	11
Little Rock	KARK-TV	4	Macon	WMAZ-TV	13	Baltimore	WMAR-TV	2
Pine Bluff	KATV	7	Macon	WNEX-TV	47	Salisbury	WBOC-TV	16
CALIFORNIA			Rome	WROM-TV	9	MASSACHUSETTS		
Bakersfield	KBAK-TV	29	Savannah	WROC-TV	11	Adams-Pittsfield	WMGT	19
Bakersfield	KERO-TV	10				Boston	WBZ-TV	4
Chico	KHSL-TV	12	Boise	KBOI	2	Boston	WNAC-TV	7
Eureka	KIEM-TV	3	Boise	KIDQ-TV	7	Cambridge	WGBH-TV	2
Fresno	KJEO	47	Idaho Falls	KID-TV	3	Cambridge	WTAO-TV	56
Fresno	KMI-TV	24	ILLINOIS			Holyoke	WHYN-TV	55
Los Angeles	KABC-TV	7	Belleview	WTVI	54	Springfield	WWLP	61
Los Angeles	KOP	13	Bloomington	WBLN	15	Worcester	WAAB-TV	20
Los Angeles	KHJ-TV	9	Champaign	WCIA	3	Worcester	WWOR-TV	14
Los Angeles	KNTX	2	Chicago	WBBM-TV	2	MICHIGAN		
Los Angeles	KRCA	4	Chicago	WBKB	7	Ann Arbor	WPAG-TV	20
Los Angeles	KTLA	5	Chicago	WGN-TV	9	Battle Creek	WBCK-TV	58
Los Angeles	KTTV	11	Chicago	WNBQ	5	Cadillac	WWTV	13
Monterey	KMBY-TV	6	Danville	WDAN-TV	24	Detroit	WJBK-TV	2
Sacramento	KBET-TV	10	Decatur	WTV	17	Detroit	WJTV	4
Sacramento	KBCB-TV	46	Harriaburg	WSEL-TV	22	Detroit	WXYZ-TV	7
Sacramento	KCCO-TV	40	Peoria	WEEK-TV	43	East Lansing	WKAR-TV	60
Salinas	KSBW-TV	8	Peoria	WTVH-TV	19	Grand Rapids	WOOD-TV	8
San Diego	KFMB-TV	6	Quincy	WGEM-TV	19	Kalamazoo	WZZO-TV	3
San Diego	KFSD-TV	10	Rockford	WREX-TV	13	Lansing	WILM-TV	6
San Francisco	KBAY-TV	20	Rockford	WTVQ	39	Lansing	WTOM-TV	54
San Francisco	KGO-TV	7	Rock Island	WHBF-TV	4	Saginaw	WKNX-TV	57
San Francisco	KPIX	5	Springfield	WHFS-TV	20	Saginaw	WNEM-TV	5
San Francisco	KQED	5	INDIANA			Traverse City	WPBN-TV	7
San Francisco	KRON-TV	4	Bloomington	WTTV	4	MINNESOTA		
San Francisco	KSAN-TV	32	Elkhart	WSIV	52	Austin	KMMT	6
San Francisco	KVEU-TV	6	Evansville	WFIE	62	Duluth	EDAL-TV	3
San Jose	KVCV-TV	3	Fort Wayne	WKIG-TV	33	Duluth-Superior	WDSM-TV	9
Stockton	KOVR	13	Indianapolis	WFBM-TV	6	Minneapolis-St. Paul	KEYD-TV	9
Stockton	KTVU	36	Indianapolis	WISH-TV	9	Minneapolis-St. Paul	KSTP-TV	5
Tulare-Fresno	KVVU	27	Lafayette	WFAM-TV	59	Minneapolis-St. Paul	WCCO-TV	4
COLORADO			Muncie	WLBC-TV	49	Minneapolis-St. Paul	WMIN-TV	11
Colorado Springs	EKTV	11	South Bend	WSBT-TV	34	Minneapolis-St. Paul	WTCN-TV	11
Colorado Springs	KRDO-TV	13	Terre Haute	WTHI-TV	10	Rochester	KROC-TV	10
Denver	KBTU	9	Waterloo-Ft. Wayne	WINT	15	MISSISSIPPI		
Denver	KFEL-TV	2	IOWA			Jackson	WJTV	25
Denver	KLEZ-TV	7	Ames	WOIT-TV	5	Jackson	WLBT	3
Denver	KOA-TV	4	Cedar Rapids	ECRI-TV	9	Jackson	WSLI-TV	12
Grand Junction	KFXI-TV	6	Cedar Rapids	WMT-TV	2	Meridian	WTOX-TV	11
Pueblo	KCSJ-TV	8	Davenport	WOC-TV	6	MISSOURI		
CONNECTICUT			Des Moines	KGTV	17	Cape Girardeau	KFVS-TV	12
Bridgeport	WICC-TV	43	Des Moines	WHO-TV	13	Columbia	KOMU-TV	6
Hartford	WGTH-TV	18	Fort Dodge	KQT	21	Hannibal	KHQA-TV	7
New Britain	WKNB-TV	30	Mason City	KGLO-TV	3	Jefferson City	KRCG-TV	13
New Haven	WNHC-TV	8	Sioux City	KTV	0	Joplin	KSWM-TV	12
Waterbury	WATR-TV	53	Waterloo	KWWL-TV	7	Kansas City	KCMO-TV	5
DELAWARE			KANSAS			Kansas City	EMBC-TV	9
Wilmington	WDEL-TV	12	Great Bend	ECKT	2	Kansas City	WDAF-TV	4
DISTRICT OF COLUMBIA			Hutchinson	KTVH	12	St. Joseph	KFEQ-TV	2
Washington	WMAL-TV	7	Pittsburg	KOAM-TV	7	St. Louis	KETC	9
Washington	WRC-TV	4	Topeka	WIBW-TV	13	St. Louis	KSD-TV	5
Washington	WTOP-TV	9	Wichita	KAKE-TV	19	St. Louis	KWK-TV	4
Washington	WTTG	5	Wichita	KEDD	16	Sedalia	KDRO-TV	6
FLORIDA			KENTUCKY			Springfield	KSTS-TV	10
Fort Lauderdale	WFTL-TV	23	Henderson	WEHT	50	Springfield	KTV	3
Fort Lauderdale	WTV	17	Lexington	WLTX-TV	18	MONTANA		
Fort Myers	WINK-TV	11	Louisville	WAVE-TV	9	Billings	KOOK-TV	2
Jacksonville	WHP-TV	26	Louisville	WHAS-TV	11	Butte	KXLF-TV	6
Jacksonville	WMBR-TV	4	Louisville	WQXL-TV	41	Great Falls	KFBF-TV	5
Jacksonville	WMBR-TV	4				Missoula	KGOV-TV	13
Miami	WQBS-TV	23	LOUISIANA			NEBRASKA		
Miami	WTV	4	Alexandria	KALB-TV	5	Kearney-Heldrege	KHOL-TV	13
Orlando	WDBO-TV	6	Baton Rouge	WAFB-TV	29	Lincoln	KOLN-TV	10
Panama City	WJDM-TV	7	Lake Charles	KPLC-TV	7	Lincoln	KUON-TV	12
						Omaha	KMTV	3
						Omaha	WOW-TV	6

CITY, STATE	CALL	CHANNEL	CITY, STATE	CALL	CHANNEL	CITY, STATE	CALL	CHANNEL
NEVADA			OREGON			UTAH		
Henderson	KLRI-TV	2	Eugene	KVAL-TV	13	Salt Lake City	KSL-TV	5
Las Vegas	KLAS-TV	6	Medford	KBES-TV	5	Salt Lake City	KTVU	4
Reno	KZTV	8	Portland	KOIN-TV	6	Salt Lake City	KUTV	2
NEW HAMPSHIRE			PENNSYLVANIA			VERMONT		
Manchester	WMUR-TV	9	Allentown	WFME-TV	67	Montpelier	WMVT	3
NEW JERSEY			Altoona	WFBG-TV	10	VIRGINIA		
Asbury Park	WRTV	58	Bethlehem	WLEV-TV	51	Danville	WBTV-TV	24
Newark	WATV	13	Easton	WGLV	57	Hampton-Norfolk	WVEC-TV	35
NEW MEXICO			Erie	WICU	12	Harrisonburg	WSVA-TV	3
Albuquerque	KGGM-TV	13	Erie	WSEE	35	Lynchburg	WLVA-TV	13
Albuquerque	KOAT-TV	7	Harrisburg	WCMB-TV	27	Newport News	WACH-TV	33
Albuquerque	KOB-TV	4	Harrisburg	WHP-TV	55	Norfolk	WTAR-TV	3
Roswell	KWSV-TV	8	Johnstown	WTPA-TV	71	Richmond	WTVR	6
NEW YORK			Lancaster	WAC-TV	56	Roanoke	WSLS-TV	10
Albany	WROW-TV	41	Lebanon	WGAL-TV	6	WASHINGTON		
Binghamton	WBNF-TV	12	New Castle	WLBR-TV	15	Bellingham	KVOS-TV	12
Bloomington	WIRI	5	Philadelphia	WKST-TV	45	Pasco	KEPR-TV	19
Buffalo	WBBN-TV	4	Philadelphia	WCAU-TV	10	Seattle	KCTS*	9
Buffalo	WBUF-TV	17	Philadelphia	WFLZ-TV	6	Seattle	KING-TV	5
Buffalo	WGR-TV	2	Pittsburgh	WPTZ	3	Seattle	KOMO-TV	4
Corthage-Watertown	WCNY-TV	7	Pittsburgh	WDTV	2	Spokane	KHO-TV	6
Elmira	WTV	24	Pittsburgh	WENS	15	Spokane	EREM-TV	3
Kingston	WKNY-TV	66	Pittsburgh	WQED*	13	Spokane	KELY-TV	4
New York	WABC-TV	7	Reading	WUEU-TV	33	Tacoma	KMO-TV	13
New York	WABD	5	Reading	WHUM-TV	61	Tacoma	KTNT-TV	11
New York	WCBS-TV	2	Scranton	WARM-TV	16	Yakima	KIMA-TV	29
New York	WOR-TV	9	Scranton	WGBI-TV	22	WEST VIRGINIA		
New York	WPIX-TV	11	Scranton	WTVU	73	Charleston	WCHS-TV	8
New York	WRCA-TV	4	Wilkes-Barre	WBRE-TV	28	Charleston	WKNA-TV	49
Rochester	WHAM-TV	5	Wilkes-Barre	WILK-TV	34	Fairmont	WPH-TV	35
Rochester	WHEC-TV	10	York	WNOW-TV	49	Huntington	WSAZ-TV	4
Rochester	WVET-TV	10	York	WSBA-TV	43	Oak Hill (Beckley)	WCAY-TV	4
Schenectady	WRCB	6	RHODE ISLAND			Parkersburg	WTAP	15
Syracuse	WHEN-TV	8	Providence	WJAR-TV	10	Wheeling	WTRF-TV	7
Syracuse	WSYR-TV	3	Providence	WNET	16	WISCONSIN		
Troy	WTRI-TV	35	Providence	WPRO-TV	12	Eau Claire	WEAU-TV	13
Utica	WTKV	13	SOUTH CAROLINA			Green Bay	WBAY-TV	2
NORTH CAROLINA			Anderson	WAIM-TV	40	La Crosse	WKBT	8
Asheville	WISE-TV	62	Charleston	WCSC-TV	5	Madison	WHA-TV*	21
Asheville	WLOS-TV	13	Charleston	WUSM-TV	2	Madison	WKOW-TV	27
Chapel Hill	WUNC-TV*	4	Columbia	WCOS-TV	25	Madison	WMTV	33
Charlotte	WAYS-TV	36	Columbia	WIS-TV	10	Marquette	WMBS-TV	11
Charlotte	WBTV	3	Columbia	WNOK-TV	67	Wausau	WCAN-TV	26
Durham	WTVD	11	Florence	WBTW	8	Milwaukee	WOKY-TV	19
Greensboro	WFMY-TV	2	Greenville	WFBC-TV	4	Milwaukee	WTMJ-TV	4
Greenville	WNCT	28	Greenville	WGVL-TV	23	Superior	WTVW	12
Raleigh	WNAO-TV	28	SOUTH DAKOTA			Wausau	WDSM-TV	6
Wilmington	WMFO-TV	6	Sioux Falls	KELO-TV	11	Wausau	WEAU-TV	7
Winston-Salem	WSIS-TV	12	TENNESSEE			WYOMING		
Winston-Salem	WTOB-TV	28	Chattanooga	WDEF-TV	12	Cheney	KFBC-TV	5
NORTH DAKOTA			Jackson	WDXI-TV	7	TERRITORIES		
Bismarck	KFYR-TV	5	Johnson City	WIHL-TV	11	Anchorage, Alaska	KFIA-TV	2
Fargo	WDAY-TV	6	Knoxville	WATE	6	Anchorage, Alaska	KTV	11
Minot	KCBT-TV	13	Knoxville	WTSE-TV	26	Honolulu, Hawaii	KOMB-TV	9
Valley City	KXJB-TV	4	Memphis	WHBQ-TV	13	Honolulu, Hawaii	KONA	11
OHIO			Nashville	WMCT	5	Honolulu, Hawaii	KULA-TV	4
Akron	WAKR-TV	49	Nashville	WSIX-TV	4	San Juan, P.R.	WAPA-TV	4
Ashtabula	WICA-TV	15	Old Hickory (Nashville)	WSM-TV	4	San Juan, P.R.	WKAQ-TV	2
Cincinnati	WCET*	48	TEXAS			MEXICAN BORDER STATIONS		
Cincinnati	WCPO-TV	9	Abilene	KRBC-TV	9	Juarez	XE-TV	5
Cincinnati	WKRC-TV	12	Amarillo	KFDA-TV	10	Tijuana	XETV	6
Cincinnati	WLWT	5	Austin	KGNC-TV	4	CANADIAN STATIONS		
Cleveland	WEWS	5	Beaumont	ETBC-TV	7	Calgary, Alberta	CHCT-TV	2
Cleveland	WNBK	3	Beaumont	KBMT-TV	31	Edmonton, Alberta	CFRN-TV	3
Cleveland	WXEL	8	Corpus Christi	KVDO-TV	22	Vancouver, B.C.	CBUT	2
Columbus	WBNS-TV	10	Dallas	KRLD-TV	4	Winnipeg, Manitoba	CBWT	4
Columbus	WLWC	4	Dallas	WFAA-TV	6	St. John, N.B.	CHST-TV	4
Columbus	WTVN	6	El Paso	KROD-TV	4	Sydney, N.S.	CJCB-TV	4
Dayton	WHIO-TV	7	El Paso	ETSM-TV	9	Hamilton, Ontario	CHCH-TV	11
Dayton	WLWD	2	Fort Worth	WBAP-TV	5	Kingston, Ontario	CKWS-TV	11
Lima	WLWK-TV	73	Galveston	KGST-TV	11	Kitchener, Ontario	CKCO-TV	13
Steubenville	WSTV-TV	9	Houston	KPRC-TV	2	London, Ontario	CFPL-TV	10
Toledo	WSPD-TV	13	Houston	KTRK-TV	13	Ottawa, Ontario	CBOT	2
Youngstown	WFMI-TV	21	Houston	KUHT*	8	Port Arthur, Ontario	CFPA-TV	2
Youngstown	WKBN-TV	27	Longview	KUVE	32	Sudbury, Ontario	CKSO-TV	3
Zanesville	WHIZ-TV	50	Lubbock	KCBD-TV	11	Toronto, Ontario	CBLT	2
OKLAHOMA			Lubbock	KDUB-TV	19	Windsor, Ontario	CKLW-TV	9
Ada	KTEN	10	Midland	KMID-TV	2	Montreal, Quebec	CBMT	2
Enid	KGEO-TV	5	San Angelo	KTKL-TV	8	Montreal, Quebec	CBMT	6
Lawton	KGEO-TV	9	San Antonio	KENS-TV	6	Quebec City, Que.	CFCM-TV	4
Muskogee	KTVZ	8	San Antonio	WCAI-TV	6	Rimouski, Quebec	CHRR-TV	3
Oklahoma City	KMP	10	Temple-Waco	ECEN-TV	6	Regina, Saskatch.	CKCK-TV	2
Oklahoma City	KTVQ	25	Texarkana	ECMC-TV	6	Saskatoon, Saskatch.	CFQC-TV	8
Oklahoma City	KWTU	9	Tyler	ELTV	7	* Educational station		
Oklahoma City	WKY-TV	4	Waco	KANG-TV	34			
Tulsa	KOTV	6	Westaco	KRGV-TV	5			
Tulsa	KVOO-TV	2	Wichita Falls	KFDX-TV	3			
			Wichita Falls	KWFT-TV	6			

Since the last compilation of TV stations was published in the January, 1954 issue of Radio & Television News, 95 v.h.f. and only 16 u.h.f. stations have been added. After the first great influx of u.h.f. stations, many would-be u.h.f. broadcasters have allowed their construction permits to lapse rather than go on the air and suffer financial losses. It can be expected that very few u.h.f. stations will go on the air in the immediate future.

Succeeding issues of Radio & Television News will list the new TV stations as they go on the air. Save this complete list and add the others to it to keep up to date.



Typical antenna with rotator installation. Note the special flexible stand-off used to prevent downlead injury.

By JACK BARR

There's nothing mysterious about the rotator—master its servicing by following the hints in this article.



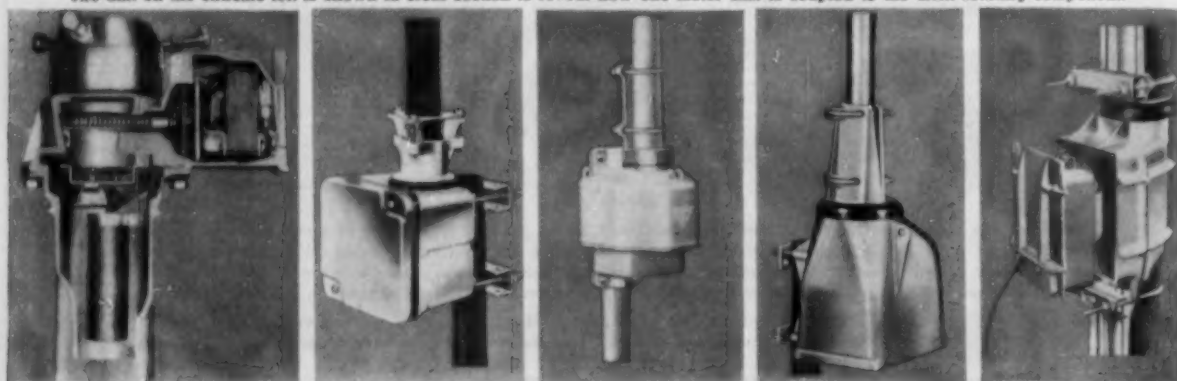
ONCE, few people outside of the ham fraternity even knew what an antenna rotator actually looked like. Today, uncounted thousands of these useful gadgets grace the top of TV installations all over the country. With the addition of many new TV stations to the roster, the rotator and high-gain broadband antenna, once confined to the far fringe areas, has been creeping farther and farther into the secondary areas.

The addition of this component to the antenna system has posed a few new problems for the service technician, not the least of which is the correct diagnosis of troubles. A wrong guess means many hours of wasted labor taking the whole antenna down and re-erecting it. Therefore, be very sure that the trouble is actually located in the motor unit before any disassembly is attempted!

Although most of the earlier rotators required removal of the antenna, some newer types feature a cartridge-type motor unit, which may be removed for servicing without taking down the whole antenna setup. With most of these, the antenna may be turned to a favorite station and locked, so that reception may be obtained while the repairs are underway. On installations using a fairly short mast, a temporary coupling may be slipped over the mast-top and antenna, held by bolts. A pair of antenna "U" bolts may be used to clamp the antenna to the mast, if desired.

Basically, rotators are all the same: a reversible motor is used to drive a train of gears which move the outer housing of the rotator, carrying the antenna around to the desired direction. The bottom part of the housing is fastened to the mast. Some sort of

Five typical TV antenna rotators. In all of them, the motor and part or all of the gear assembly can be removed for servicing. The unit on the extreme left is shown in cross section to reveal how one motor unit is coupled to the mast rotating component.



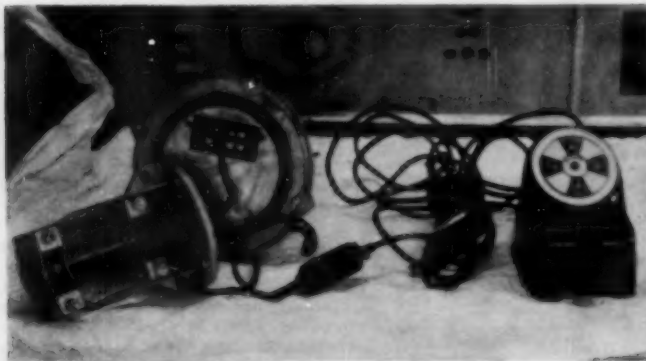


Fig. 1. Partially disassembled view of the CDR TR-2 rotator with the control box and its eight-conductor cable.

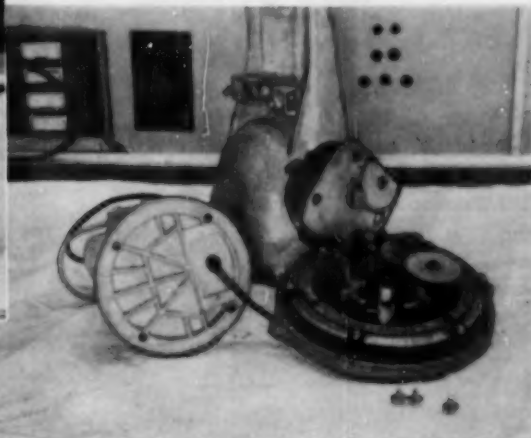


Fig. 2. The motor of the CDR rotator has been swung back to expose the gears. Note the ball bearings around the base.

remote direction indicator is supplied for the operator so that he may know in which direction the array is aimed.

Motor circuitry on the earlier types is practically all the same. A reversible motor, using a starting capacitor, and powered by about 24 volts a.c., supplied by a small transformer in the remote control box, drives the gear train, either through a pinion or worm gears. One exception is a rotator which uses dual motors, one for each direction. The motors are the same size as the husky ones used in phonographs. They contain two windings, connected as shown in Fig. 3.

The control box contains the starting capacitor, transformer, and a double-pole, double-throw switch that selects the direction of rotation and controls the power to the unit.

One very popular and sturdy unit is the *Cornell-Dubilier "Radiart TR-2."* (See Fig. 1.) This is the continuous-travel type, which rotates as long as the switch is held down. It uses an 8-wire cable, seen between the units in the photograph. The terminal board is on the bottom of the rotator unit, and the control box is at the right. The mast clamp, unbolted from the top, is at the left.

A disassembled view of the same

unit is shown in Fig. 2. The gear-train is visible at the right side of the bottom part; the motor has been unbolted and laid back. The small pinion on the end of the motor shaft is made of plastic, for quiet operation. At the center of the unit is the "floating-stop" lever. Two bosses on the housing and two more on the moving part engage this lever to stop the rotator at the end of its travel. The lever is pivoted in the center, so that the top part of the rotator may travel about 370 degrees, for aiming directly at stations near the end of travel.

The contents of the control box used with this rotator are shown in Fig. 4. The power transformer is in the center. This supplies both 24 volts a.c. for the motor and 6 volts a.c. for the indicator lights, which are standard #47 radio pilot lamps. The actuating switch at the front controls direction and power. The capacitor used in the motor circuit is barely visible at the back of the transformer.

Troubles in these and similar rotators seem to center mostly in the switches: if the rotor does not operate at all, by all means check the control box first, to see that the proper voltage is being supplied to the motor. If in doubt, try another control box!

Some difficulties have been encountered with the a.c. portion of the switch, due to burning of contacts. Replacement of the switch is the best cure. Of course, the other contacts should not be neglected; due to the low voltage, any dirt or corrosion here will cause slow operation of the motor, and possible burnout.

Cable troubles may be checked out with an ohmmeter. If the voltage is apparently OK, but the motor hums and refuses to run, try substituting another capacitor. Remove the sus-

(Continued on page 152)

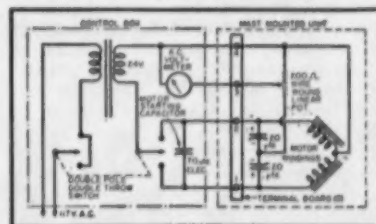


Fig. 3. Schematic diagram of the motor circuits and position indicator of the Vee-D-X TV antenna rotator, model AR. The 200-ohm pot is automatically adjusted by the mast-mounted rotating section, sending a voltage proportional to the position down to the remote indicator.

Fig. 4. Interior of a typical control box showing the transformer in the center with the motor starting capacitor behind it and the actuator switch in front of the transformer.

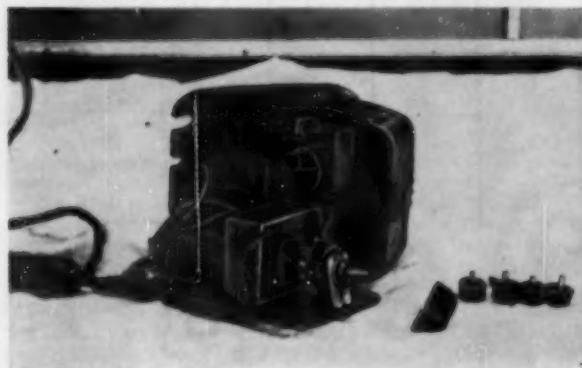


Fig. 5. View of an Alliance rotator showing the worm-gear drive. The dark collar below the main driving gear contains position indicating pot, similar to that shown in Fig. 3.



NEW TV CIRCUITS FOR 1955

By **ROBERT B. GARY**

*A survey of new TV circuit developments used by
TV manufacturers of interest to service technicians.*

LOOKING over the crop of new TV receivers which are now going into production we find that the situation has not changed very much from last year. Many leading manufacturers are stressing low cost black-and-white receivers while getting ready to release small quantities of color TV sets. The circuitry in the new monochrome sets is not too different from previous models, but several manufacturers have included new wrinkles or modified conventional circuits to make for lower cost, greater stability, or simpler adjustment. Printed circuit techniques as well as the use of the new series heater tubes in all parts of the receiver have been described in previous articles and both of these features are finding a wider application in the 1955 models than they did last year. The same applies to vertical chassis which have been adopted by many leading manufacturers.

Among the innovations advertised by TV manufacturers there are two circuits which, because they operate differently from their conventional counterparts, deserve some discussion. These are the new pentagrid sync pulse separator and the new linearized pentode sweep amplifier.

Pentagrid Sync Separator

Although one or two manufacturers have used a 6BE8 pentagrid tube in their noise immunity, sync amplifier, or separator circuits, the application of this type of tube is only now becoming widespread in the industry. A new pentagrid tube, the 6CS6, originally developed for color TV sets, is used by Raytheon, Zenith, Motorola, and others in some version of the circuit shown in Fig. 1. The major advantage of this circuit is that it is quite immune to noise pulses and will provide very stable sync operation in areas of heavy ignition and similar interference.

Basically, two signals operate the pentagrid sync separator, one supplying the actual sync pulses and the other for gating. As shown in Fig. 1, the output of the video detector is applied to the control grid of the 6CS6 while a portion of the video signal from the 1st video amplifier plate is applied to the third grid. This means that the negative polarity sync pulse appearing at the control grid can only be amplified when the third grid is positive enough. By proper biasing, the circuit is so arranged that the amplified positive sync pulses from the video amplifier plate gate the tube on and off. Video signals cannot pass because their amplitude at the third grid is insufficient to "open the gate." Noise pulses may have sufficient amplitude, but since they will not appear instantaneously at both the detector and the video amplifier output, little noise will pass the tube. Furthermore, the plate and screen voltage of the 6CS6 are kept low enough to limit any stray noise pulses that might ride through.

The third grid circuit contains an R-C combination which will further reduce noise pulses due to the double time constant of C_1 , R_1 and C_2 , R_2 . Only the repetitive horizontal and vertical synchronizing pulses can build up sufficiently to gate the tube. Since the signal from the video detector is negative in polarity, a small positive voltage is placed on the control grid of the 6CS6 through a bleeder from the "B+" supply.

In many of the receivers using this pentagrid sync separator the output is connected directly to the vertical integrating network and the horizontal a.f.c. system. It should also be mentioned that by making R_2 variable or part of a tapped switched resistance, the level of the noise immunity can be adjusted to suit local reception conditions.

Pentode Sweep Amplifier

Even in the earliest TV receivers,
(Continued on page 163)

Fig. 1. Pentagrid sync separator circuit, versions of which are used by Raytheon, Zenith, and Motorola in their new sets.

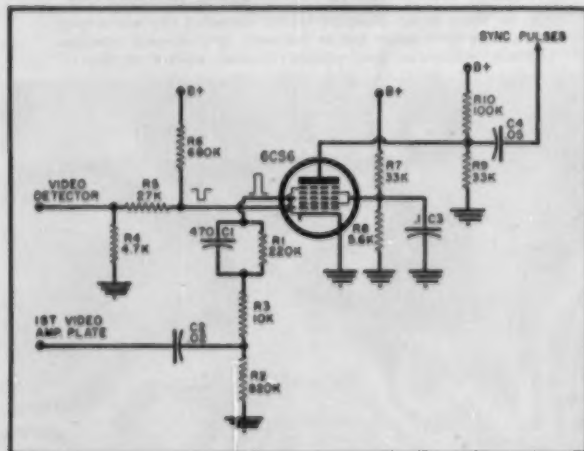
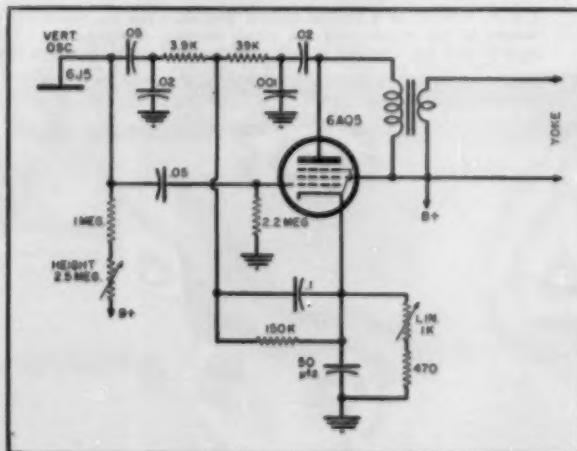


Fig. 2. New vertical deflection output circuit used in the RCA model KCS89A and others, using a pentode amplifier tube.



SERVICING ELECTRIC GUITARS

By BILL BOUIE

A LUCRATIVE field of ready revenue that is being overlooked by the average electronic service technician is the servicing and repair of electric musical instruments. These instruments, especially electric guitars, have become a very definite part of the American musical scene since their introduction a little over twenty years ago. Just turn your radio dial to any current program of popular music and you are bound to hear the fascinating tones of one of these instruments. In the past two decades, thousands of these instruments have been manufactured and sold. Fig. 1 shows some current models of electric guitars manufactured by *Gibson, Inc.* of Kalamazoo, Michigan, a firm which pioneered the development of electric guitars.

Basically, the electric guitar consists of the instrument itself, a pickup with associated volume and tone controls, and an amplifier and speaker combination housed in a portable cabinet. The guitar and amplifier are connected together by a detachable length of microphone cable. The pickup is built right into the guitar, directly beneath the strings. Volume and tone controls are mounted on the front of the instrument for ready control of the sound level and the quality of the musical tones. Fig. 2 shows these basic features mounted on an electric Spanish guitar.

The electric guitar is a skillfully-designed and well-constructed instrument, but, like any other manufactured product, it is subject to occasional malfunctioning and breakdown. Since the musician depends upon his instrument to make his living, any defect in its operation becomes an economic problem until the instrument is fixed. So it is mandatory that the instrument be restored to proper operation with the least possible delay. And here's where you come in.

The average service technician is hesitant to handle repairs on electric musical instruments. The feeling exists that you have to know something about music in order to repair them. Of course, this is not so. Repairing the electrical system of a musical instrument is quite similar to repairing an electric phonograph. Both devices have essentially the same features: pickup, controls, amplifier, and speaker. In the one case, the vibrations that form the sound pattern are picked up from a record; in the other, the vibrations are

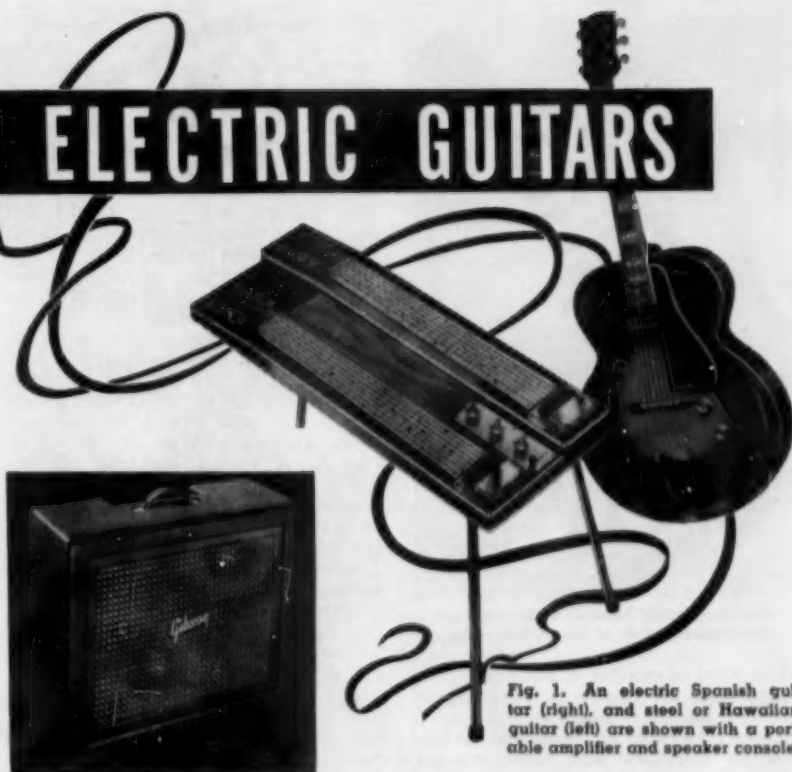


Fig. 1. An electric Spanish guitar (right), and steel or Hawaiian guitar (left) are shown with a portable amplifier and speaker console.

Part 1. The musician depends upon his instrument for his livelihood—good servicing is vital and pays well.

picked up from the plucked strings of the guitar. The main problem appears to be how to get at the remote controls and pickups which, with their associated electrical wiring, are mounted in the guitar.

A classic letter from one repairman to the service manager of *Gibson* reads: "Dear Sir: We have one of your electric guitars in our shop for repair. The trouble seems to be in the pickup. Which do I remove, the front or the back of the guitar in order to get at it?"

If this question is bothering some of you, let me hasten to say that you don't remove either side. Any such attempt would completely ruin the guitar. There is an easier way to get at the pickup and controls which will be discussed when we cover actual servicing techniques.

Pickups

Magnetic pickups are used on electric guitars and are made in several forms. Nearly all of the pickups used on electric guitars today are built right into the instruments. Several years ago contact-type pickups were in considerable use to enable conversion of acoustic (non-electric) guitars for use with an amplifier. But since the trend in recent years has been to the guitar with the built-in pickup, the contact-type pickup will not be discussed here.

Simplified drawings of three types of guitar pickups in current use are shown in Fig. 3. Only the essential parts of the pickups are illustrated, details of mounting construction being omitted in order to accent operating features. In operation, the steel strings used on these instruments serve as a path for magnetic flux lines between the magnets and the steel pins in Fig. 3A and from the top of the magnetic pins to the bottom in Figs. 3B and 3C. When a string is plucked, it vibrates back and forth across the top of its pin, causing rapid variations in the flux cutting the pickup coil and inducing a voltage in the pickup coil. This voltage fluctuates in accordance with the vibrations of the string. Passing through the amplifier, the amplified signal voltage produces, at the loudspeaker, a faithful reproduction of the tone of the vibrating string.

The pickup shown in Fig. 3A uses two horseshoe magnets connected with opposing poles as shown. The coil, which is wound on a shaped and fitted coil form, is mounted inside the bend of the magnets. Soft iron or steel pins, about an eighth of an inch in diameter, are mounted in the coil form and spaced so that each pin is directly beneath a string when the pickup is mounted on the guitar. The strings pass through the air gap formed between the coil form and the magnets.



Fig. 2. Electric Spanish guitar showing the various parts of the pickup circuit.

The steel pins offer a low-reluctance path for the magnetic flux which readily passes through them.

The pins extend through the bottom of the coil form and make contact with the underside of the magnets when the coil is mounted in place. On the top of the coil, the pins extend slightly beyond the coil form and approach the strings, but do not come close enough to interfere with their vibrations. The pins are cut to slightly varying lengths so that the space between pin and string is consistent for all strings despite their varying thicknesses. A knurled nut on each of the two mounting brackets permits some adjustment of the pickup.

While this type of guitar pickup was one of the first to be designed, instruments using it are still popular. The pickup has the advantage of physical ruggedness and high-level output. The latter was a necessity for the small, low-gain amplifiers used in the early development of electric instruments. However, a principal disadvantage is the weight of the pickup due to the comparatively heavy horseshoe magnets. This makes its use a problem in the electric Spanish guitar, since it has to be mounted on the relatively thin front panel of the instrument.

A type of pickup which compromised on the weight problem and also provided other advantages is shown in Fig. 3B. In this construction, a comparatively light bar magnet is used with the coil form mounted above it. The pickup pins take the form of small screws which are individually adjustable to insure tone balance. Two or more of these light pickups can be mounted on the guitar without impairing its handling qualities.

The pickup shown in Fig. 3C is a lightweight unit which is quite popular. In this construction, the horse-

shoe magnets and the bar magnet of Figs. 3A and 3B, respectively, are replaced by small cylindrical magnets which pass through the coil form and take the place of the steel pins and adjustable screws used in the other two pickups. These cylindrical magnets are so spaced that one lies directly beneath each string on the instrument. The magnets are spring loaded and can be individually adjusted by small screws mounted beside them on the top of the pickup. Adjusting these screws increases or relaxes pressure on the spring mounting, thereby raising or lowering the magnet with respect to its associated string.

Quite often, two or three pickups are mounted on the guitar to provide a variety of tonal effects. Instruments using multiple pickups are shown in Fig. 5. A switch mounted on the guitar permits the selection of any combination of pickups desired. When more than one pickup is used, the extra unit(s) is connected in parallel.

Remote controls for convenient adjustment of both tone and volume are mounted directly on the instrument (see Fig. 2). They are connected across the output of the pickup as shown in Fig. 4. The volume control, R_v , is usually a 25- or 5-megohm potentiometer, but other values have been used and may be encountered. The tone control, R_t , is usually a 5-megohm potentiometer with a capacitor connected in series with one terminal to shunt high frequencies to ground and accentuate the bass tones. The value

of the capacitor varies, but is usually anywhere from about .02 μ fd. to .05 μ fd.

While a tone control to accentuate the high frequencies is not usually incorporated as a remote control, sometimes this feature is encountered. A simple control of this nature is shown connected in Fig. 4. Sometimes the two tone controls are ganged together so that turning the control knob one way accents the bass, while the opposite direction brings out the treble. At the midpoint of rotation both controls are out of the circuit.

Dual sets of volume and tone controls are used in multiple pickup arrangements, each set of controls being independent of the other. Very rarely will you encounter more than two sets of controls on the one instrument. Sometimes a single tone control will be used on the guitar to accommodate all the pickups.

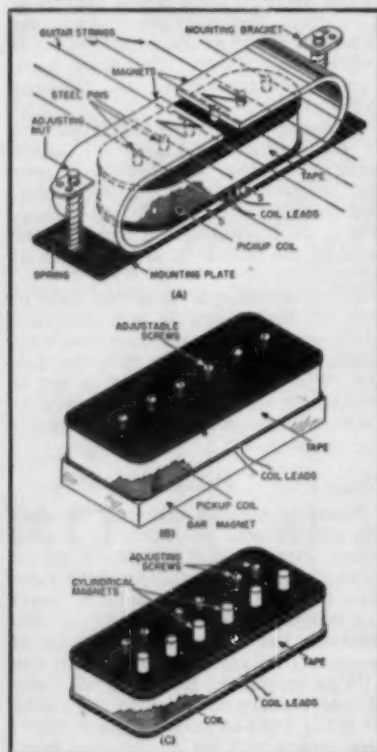
The signal output from the remote controls is fed to a standard-type microphone jack built into the guitar (see Fig. 2). A connecting cable (patchcord) completes the circuit between guitar and amplifier.

The patchcord is a length of rubber-covered, shielded, single-conductor microphone cable with a microphone plug at each end for connection between the output jack on the guitar and the input jack on the amplifier. The center conductor is the "hot" lead and carries the signal while the shield on the cable is used as the ground lead. Because they come in for a good deal of handling, these connecting cables are a common source of trouble and should be the primary check on an instrument with faulty operation.

A wide assortment of amplifiers is used with electric guitars. The choice of amplifier depends upon the application. In small musical combinations, where high power output may not be an essential requirement, a relatively small amplifier of five or ten watts output, or even less, may suffice. For the man who works with a large orchestra, a high-level output with other added features may be necessary. In this case, a large amplifier of twenty-five watts or upwards may be needed. However, the amplifier rarely becomes so large and bulky that it is unwieldy to handle, although some of them may have casters mounted to facilitate moving them about. For the most part, the amplifiers you will be called upon to service will be portable and easily maneuverable by one man. In the majority of cases, the amplifier and speaker, or speakers, are contained in a wooden cabinet which also serves as the speaker baffle.

The amplifiers do not differ in their essentials from any other type of audio amplifying equipment. In the final analysis, they all consist of tubes, capacitors, resistors, etc. Any of these components becomes defective in time, and making repairs on musicians' amplifiers is not a whit more difficult than servicing any other piece of sound equipment. However, highest quality

Fig. 3. The essential parts of three types of electric guitar pickup units.



replacement parts are a must and meticulous service is a requirement. Slipshod work cannot be tolerated and the careless technician will find his customers taking their equipment elsewhere. Because of the high-quality service demanded, these jobs invariably result in higher remuneration, and that means more money in the till.

Service Clues

When a musician brings a defective electric guitar into your shop for repairs, he will be principally concerned with getting it fixed as soon as possible, and he will rarely haggle about the cost. Because of his concern, he is usually much more cooperative than most customers in answering questions or in demonstrating the defect.

No doubt some of you do not place much stock in a layman's descriptions of defects in his electric equipment, nevertheless, a few well chosen questions can sometimes result in an immediate clue to the cause of the trouble. At least, the answers can often provide a hint as to what tests should be made first. The following are examples of some questions you might ask.

1. *When did the equipment break down?* The answer to this will tell you whether the defect has just occurred, or whether the equipment has been malfunctioning for some time. If the latter, then you'll probably want to spend extra time on tests and heat runs because of possible dried-out capacitors and deterioration of other parts due to moisture, dust, etc.

2. *Did it stop suddenly or has it been operating poorly for some time?* A surge in the electric supply line might have blown a fuse or a tube may have burned out, or some other simple thing may have happened to cause sudden breakdown. If the equipment has been acting poorly over a period of time, you would naturally look for other possible causes.

3. *Was the instrument being played at the time of breakdown or had it just been plugged into the power line?* In some areas, especially in older sections of large cities, the supply voltage is d.c. Plugging an a.c. amplifier into a d.c. line would either blow a fuse or burn out a power transformer.

4. *Has it ever broken down before? If so, what was repaired?* You should always make a check on the repairs made by other technicians to make sure that the job was properly done, and that high-quality parts of the correct values were used in the repair. If, however, you find a mistake in the other fellow's work, don't put him on the pan to impress the customer with the higher quality of your own work. Just go ahead and make the necessary corrections. You're being paid for the job. Besides, panning your fellow technician makes all other repairmen suspect in the eyes of the, quite often, skeptical public.

5. *Did the equipment hum badly or have a weak and/or distorted output*

before it broke down? Again, the answer should suggest some plan of attack; filter capacitors, coupling capacitors, tubes, etc.

6. *Does the instrument have scratchy or crackling noises?* If noise only is present, the customer may tell you this when he first describes the defect, but other symptoms may exist and he may overlook telling you about the original noise, so ask him. The first suspect, in this case, would be the connecting cable.

7. *Has anyone attempted to correct the condition? Were the tubes pulled out for testing or were other parts touched?* This probably should have been question No. 1. When his equipment breaks down, sometimes in sheer desperation the musician will turn to anybody that claims any knowledge of electricity to help him get it operating again so he can go on working. The things these characters can do to the equipment is often fantastic. Pulling out the tubes and switching them all around is the least. Wiring is changed and resoldered, usually with cold solder joints all over the place. If anyone has attempted to fix the equipment, be especially critical in your examination. You should always suspect that the tubes have been switched around. Even the musician, himself, may try this to restore operation.

8. *Have any new strings recently been put on the guitar? Are they the same brand as used formerly?* Sometimes, the complaint is weak output from one or more strings. Except in very rare cases, this rules out a defect in the electrical circuits and concentrates attention on the strings themselves. The strings made for electric guitars are constructed of high-quality steel. Nonmagnetic strings, such as brass or gut, have no effect upon the magnetic field of the pickup, resulting in no output. Inferior types of strings provide weak output. If strings of this nature

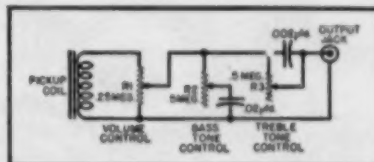


Fig. 4. Schematic diagram of a pickup circuit providing controls of volume and both bass and treble frequency ranges.

have been strung on the guitar, they will have to be replaced. Use the hand-made, "Mona-steel" strings manufactured by Gibson, Inc., which are widely used by professionals on the electric guitar.

9. *Has the equipment been blowing fuses? Did it smoke or have a bad odor when it broke down?* This would indicate an internal short, probably in the power supply.

10. *If the operation is intermittent, how long does it take to cut off? To come back on again?* It is important to know this. Sometimes the equipment will run OK for hours or even days before cutting off. It would be a bit silly in such a case to stand there waiting for the intermittent to occur during a ten-minute preliminary test.

11. *Has the instrument or amplifier been dropped or roughly handled?* Musicians do a lot of traveling from job to job. Public carriers and automobiles are a bit rough on electronic equipment. Tubes jar loose, wire connections break, and mounting screws work loose, among other things.

These questions are given as samples only. You may, and probably do, have additional ones that will fit your situation better. A word of caution, however, is in order at this point. Don't take the answers too literally. If he says he just had the tubes checked, check them again anyway—tubes can always burn out. Next month, specific servicing information.

(To be continued)

Fig. 5. Electric Spanish guitars with multiple pickups for special tone effects.



Certified RECORD REVIEWS

By BERT WHYTE

"FIVE, four, three, two, one . . . Blooie!!!

The bomb went off on Jan. 3, 1955. No, not the Atom bomb, thank Heaven, but the bomb dropped by RCA Victor. On this date Victor announced it was cutting the price of its records as much as 40%. The record industry was caught completely off balance and is still rocking from the effects of this explosion. Reaction was quick in coming. At first, several other companies issued statements that they would "hold the line" on prices. This may have been prompted by memory of a brief price war set off by Victor in February of 1954. But as bold and very-much-to-the-point statements by Frank Folsom, president of RCA appeared in the newspapers, emphasizing the permanency of this decision, resistance to the idea soon vanished. As of this writing here is the situation concerning record prices: Most 12-inch classical and popular LP's in the Victor catalogue will be priced at \$3.98. Ten-inch LP's will be \$2.98. Columbia was the first to follow the Victor example and their prices are similar. The same applies to London records. All companies reserve the right to charge more for certain items which, by their nature, are more costly to produce. There is no way of knowing at the present time just what recordings will be considered "special." In any case, "specials" will be priced from \$4.98 to \$5.95. Officially, the three companies mentioned are the only ones who have cut prices. By the time you read this, most of the other record companies will have joined the parade. They can hardly afford to do otherwise! This may well be the long-threatened drive to oust the smaller companies from the industry. No doubt about it, this price situation will separate the "men from the boys," and many a small company will bite the dust. This is, in many ways, a lamentable state of affairs, as many a gem has come from the small independents. There will be those who may try to maintain the old \$5.95 price. This is foolish indeed. Consider a hypothetical case with Mr. Average Record Buyer, for a moment. Our friend has decided he wants to buy a Beethoven "5th Symphony." He certainly has a wide choice of recordings here. He can have Toscanini and the NBC Symphony Orchestra, or Bruno Walter and the New York Philharmonic, etc., at a cost of \$3.98. Can you think of any reason why our friend should lay out \$3.95 for the small company label with Karl Glutz und der Sauerbraten State Symphony Orch.?

Admittedly, this is an exaggerated case, but unless the small label has some virtue like a fabulous sound, chances are that the buyer will stick with the big names and the smaller price. The small labels that survive, will be the ones who cut their price to meet the competition and who upgrade the quality of their recordings. Yes sir, the record industry is going to be mighty rough in 1955 and, unfortunately, somebody is going to get hurt!

Record industry policies aside, I'm sure that the most important thing to you, is the increased buying power of your record dollar. In N. Y. and Chicago and a few other big towns, record lovers have been able to buy from the big discount houses and save up to 40 per-cent. Now everybody, everywhere, can have the same advantage as the city slickers. (Well, not quite . . . Sam Goody, the Record Hunter, and several other discount houses are even cutting the new price and you can buy 12" LP's for \$3.19.) In any case, you'll get more music for your moola. Since this new price will mean greater sales volume, it will stimulate record production to undreamed of quantity. This will have its good and bad points. The LP flood will become a torrent, the problem of duplication will be fantastic, and at the same time we will get more new music than you've ever dreamed of, Horatio. We reviewers will be inundated, and we will need more time to listen and evaluate, more space or shorter reviews, and somebody to subsidize our electric bills.

I'll start the ball rolling by giving you as many reviews as possible this month. Naturally they will be shorter, but with your newly-found wealth I thought I had better give you a big selection from which to choose. As far as I know at the moment, the prices I list for each record will be correct, but I would suggest you check carefully with your record dealer before buying!

Equipment used this month: *Pickering* 260 cartridge and 190B arm, *H. H. Scott* 121 preamp-equalizer and 232-32 watt amplifier, *Components Corporation* turntable, *Electro-Voice* "Georgian" loudspeaker; tape equipment: *Ampez* 600.

STRAVINSKY L'HISTOIRE DU SOLDAT LES NOCES

Vienna Chamber Choir, chamber ensembles of the Vienna State Opera Orchestra and soloists conducted by **Mario Rossi**. Vanguard VRS 452. NARTB curve. Price \$5.95.

Rarely has the music of Igor Stravinsky been so well served as in this Vanguard recording. The "L'Histoire du Soldat," while written for a small chamber group, generates the same type of excitement that has endeared "Le Sacre," "Petrouchka" and the "Firebird" to so many audiophiles. This is the second instrumental version available on LP and is in every respect superior to the old Bernstein-Victor recording. Mario Rossi continues to display his mastery of the modern idiom with his tense and energetic reading of this complex score. His tempi are considerably faster than were Bernstein's, and the result is a more tightly-knit, more exciting exposition.

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publisher of this magazine.

This is the third recording of "Les Noces" and coming so soon on the heels of the recent Vox effort, makes for interesting comparison. Number one difference is that this recording is sung in the original Russian while the Vox was in English. Strictly a matter of taste here, but I feel that in a work where the human voice is used in such complex rhythmic fashion, the Russian "fits" much better than the English. The Margaret Hillis choir has the edge in matter of balance and precision in the Vox recording, and this Vanguard disc has much the superior soloists. The soprano in the Vox version did a remarkable job, but she is no match for the superb artistry of the illustrious Ilona Steingruber. Soundwise both "L'Histoire" and "Les Noces" are magnificent. In "L'Histoire" you will find some fastidiously "live" brass and woodwind sound coupled with percussion which is super-clean and of great impact. Recording is very wide in frequency and dynamic range and is a brilliant example of ultra-close type of sound, proper for this "dry" sort of music. "Les Noces" is even more cleanly articulate than the Vox recording and has greater dynamics. If I must quibble about something it is the occasional "overload" or "blasting" encountered in the choral sections. By no means a serious defect, it will escape notice on all but the very best equipment. Everything considered, this is a splendid coupling of Stravinsky works which should have a great appeal for those audiophiles who think anything "post Le Sacre" is dullish classicism. The NARTB curve did not need adjustment. Surfaces were quiet in my copy.

BEETHOVEN SYMPHONY #6 (PASTORAL) SOUNDS OF NATURE

NBC Symphony Orchestra conducted by **Leopold Stokowski**. Victor LM-1830. RIAA curve. Price \$3.98.

No, Beethoven did not write a work called "Sounds of Nature." This item is a little bonus from Stokowski in which he compares natural sounds with the music Beethoven wrote purporting to depict these sounds. A few of the more hoighty-toighty critics have screamed bloody murder about this alleged affront to Beethoven. They don't like having a "program" ascribed to the "Pastoral" symphony. I think they are exaggerating the cause quite out of proportion. I'm sure even the most untutored music lover would not compare the music of Beethoven with the overblown, derivative, and imitative horrors perpetrated by some of the 19th century romantics. Beethoven's "3rd," "5th," "7th," and even the "9th" symphonies have had "programs" ascribed to them by certain writers from time to time. I make no case for "program" in these works, but surely the most obtuse critic will agree that if any of Beethoven's symphonies has a program, it is the "6th." What Dr. Stokowski has done on this disc is to give us an intensely personal and ultra-dramatic reading of the "6th" and at the conclusion of the work . . . these "sounds of nature." This section is a narration by Dr. Stokowski in which he incorporates the actual sound of a brook, of birds, and a rip-saw-thunderstorm. The music Beethoven wrote to describe these sounds is played by the orchestra after each example and then the two are combined . . . the natural sound and the music! The result is quite fascinating. One does hope however, that if this idea spreads it will be used with discretion. Can you imagine what it would sound like to have the music of Honegger's "Pacific 231" combined with the thunderous roar of the locomotive of the same name! Soundwise this is one of the best recordings of the "Pastoral" in the catalogue. Of the multi-mike console-mix type of sound, it has the

(Continued on page 133)

ONE of the most profitable, but at the same time, one of the most neglected, sources of revenue for radio service technicians lies in the field of automobile radios. For some inexplicable reason most service technicians seem loathe to undertake repair work involving auto radios. By adopting such an attitude, they are depriving themselves of a good source of income.

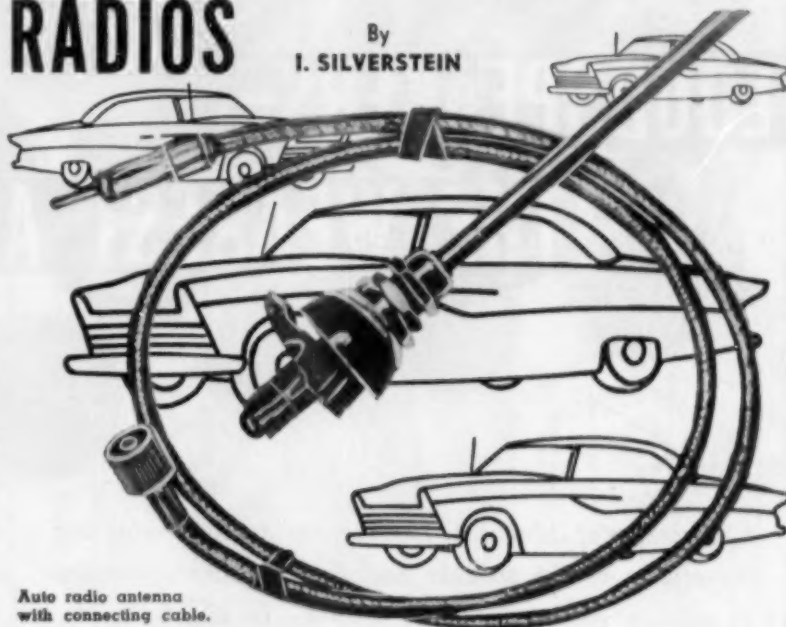
Peculiarly enough, the greatest difficulty connected with this type of servicing is either gaining access to the chassis or removing the set from its mounting! Once you have accomplished that, 75 to 85 per-cent of your work is completed. In one *Pontiac* model, for instance, it is necessary to remove the glove compartment and dashboard clock before you can remove the radio! However, the 1951 *Plymouth* radio has four screws with spot-welded nuts on the dashboard. It is only a matter of seconds to remove it. But this, unfortunately, is the exception rather than the rule.

For these reasons the largest part of a service technician's charge will be represented by his investment in time and labor in pulling the set rather than in servicing it. Up to 1941 it was a comparatively simple task to pull sets. After that, it seems, the automobile designers managed to clutter up the dashboard with all sorts of obstacles to easy radio removal.

Fig. 1 shows the schematic of a typical auto radio receiver, in this case the *Motorola CTM3* which was designed for installation in 1953 *Chevrolets*. Note that it differs essentially from the conventional receiver in its tuning circuit and power supply. The tuner has ganged, permeability-tuned coils rather than variable capacitors and the power supply has a vibrator that converts the d.c. from the auto battery to an approximate square wave of a.c.

SERVICING AUTOMOBILE RADIOS

By
I. SILVERSTEIN



Auto radio antenna with connecting cable.

The toughest thing about auto radio servicing is removing the set from the auto; after that: gravy.

As far as servicing the set itself is concerned, there are three main sources of trouble. You can count on 49 out of 50 sets having them.

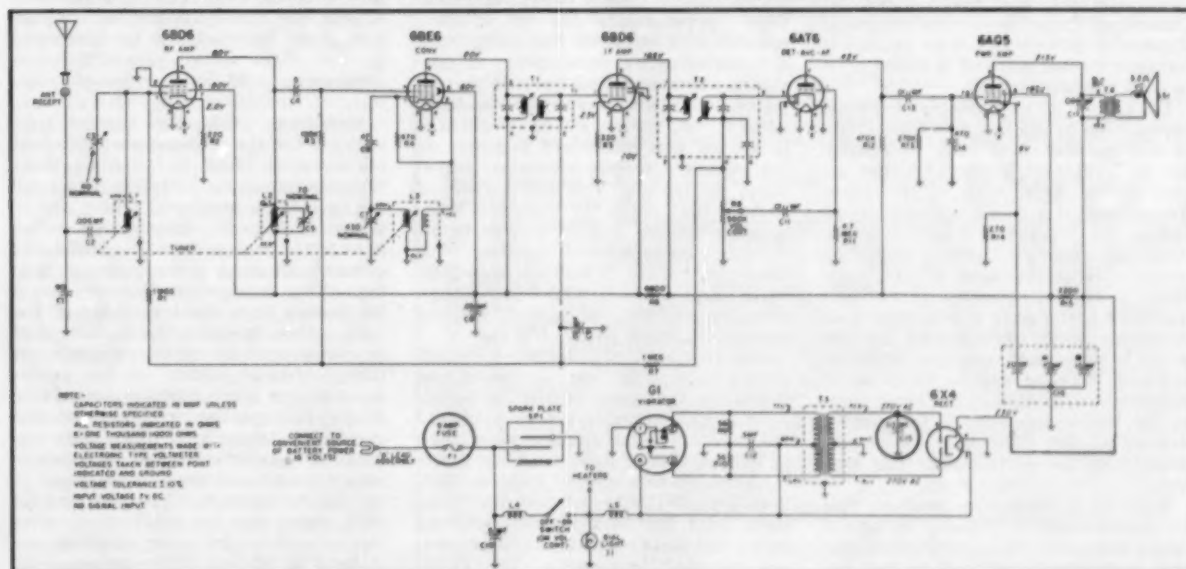
1. The rectifier may be bad. This was usually an OZ4 gas tube for sets up to and including 1948. (See Fig. 2.) The usual symptom is that the set will play intermittently or only where the going

is bumpy. The OZ4, for those meeting it for the first time, is a miniature, cold-cathode type of gas rectifier that typically delivers 90 ma. of current. Where the rectified current requirement is lower, a 6X4 or 6X5 vacuum rectifier will be found.

2. The vibrator contacts may be

(Continued on page 165)

Fig. 1. Complete schematic diagram of a typical auto radio. The fuse, F_1 , and the buffer capacitor, C_{10} , which are circled, are two of the commonest sources of trouble in these receivers. The receiver diagrammed here is the *Motorola model CTM3*.





LOUDSPEAKERS-

THE WEAKEST AUDIO LINK

By
HAROLD REED
Research and Engineering
U.S. Recording Company

A discussion of laboratory loudspeaker measurements and the effects of the speaker enclosure on such responses.

IT IS axiomatic that any system is just as good as its weakest link. A sound reproducing system, of course, is no exception to this truth, and it is well known that in any properly designed audio system, the loudspeaker falls into this category. But, although we have quickly classified the output transducer of the sound system as a weak sister, we must just as quickly come to its defense.

When viewed from the purely physical standpoint, the loudspeaker is an extremely simple device, a magnet, a moving coil in a magnetic field, a paper cone to move back and forth to provide air pressure variations in accordance with applied electrical potential variations, and that's about all. Considered from the electro-acoustical standpoint, however, it is an extremely complex mechanism and is called upon to do a tremendous job.

Dr. Olson¹ gives a clear and concise explanation of the complex mechanism of the speaker cone and, as pointed out by Professor Terman,² piston action of the cone, even at the lower frequencies, is a rough approximation, and as the frequency is increased the vibrations become waves, radiating outward from the apex of the cone. Thus, in the reproduction of complex waveforms, the cone is called upon to reproduce many frequencies in the audio band, simultaneously. Different areas of the cone will be vibrating at different frequencies at the same time. At the higher frequencies, the outside section of the cone may be out-of-phase with the portion near the cone apex.

When it is, therefore, realized that the loudspeaker is required to acoustically reproduce the sounds of all musical instruments, as well as the hu-

man voice, not only individually, but simultaneously, it can be appreciated that this simple device is a remarkable piece of apparatus.

In evaluating detailed loudspeaker performance, test data taken for a number of loudspeaker characteristics is necessary. Beranek³ lists seven of these physical characteristics in the following order: frequency response, directional characteristic, efficiency, distortion, impedance, rated power-handling capacity, and transient properties. Of these seven, perhaps in the majority of loudspeaker applications, frequency response, efficiency, and distortion are the three most important and can exert great influence on equipment design when rigid contract specifications are to be met, coupled with economic feasibility from a manufacturer's standpoint. In considering and measuring speaker characteristics as mentioned herein, the loudspeaker and the enclosure in which it is housed are considered together as the complete electro-acoustical transducer system and it is well known, of course, that correctly designed loudspeaker baffling and enclosures result in improved acoustical response with lower transducer distortion. Recently, the author, working with other design and development engineers, became engaged in these considerations.

Specifications of the sound reproducing equipment to be developed called for the rated output to be expressed as a sound pressure level and the absolute value to be no less than 95 db (re. 0.0002 dyne/cm.²) at a distance of 10 feet on the speaker axis. This acoustical measurement was to be made with the loudspeaker operating under free-field conditions and at various specified frequencies. The arith-

metical average of the outputs obtained at these different frequencies was then to be taken as the rated output of the equipment and must be at least 95 db as mentioned before. Distortion and frequency response measurements were to be conducted in the same manner.

An amplifier was designed in accordance with well proven engineering procedures and with such gain that the output should have been sufficient to satisfy the requirements with a moderately-priced, 8-inch loudspeaker. The equipment failed to satisfy the specifications as to rated output, distortion, and frequency response. Rated output, measured as outlined, was on the order of 77.7 db. (re. 0.0002 dyne/cm.²) distortion over 8%, and frequency response as shown by the curve of Fig. 1. This first test was made in a laboratory anechoic chamber. Note the deep hole in the 1000 cycle region. The response characteristics of the electronic portion of the system proved to be in accordance with good engineering design.

Numerous loudspeakers were substituted for the original one, different makes were tried, but the specifications could not be satisfied. The original enclosure employed was as illustrated in Fig. 2. Attention is called here to the recessed speaker baffle and center positioning of the speaker opening. This recessed baffle was set in 3½ inches from the front edge of the case. Due to space limitations and economic considerations, expansion of the electronic portion of the equipment and/or a much higher priced and larger loudspeaker were out of the question. After many more tests one make of speaker exhibited some promising results and gave some hope of solving the problem. The hole around 1000 cycles was not nearly as deep as the others in the same original enclosure of Fig. 2. The response of

this combination is presented in the curve of Fig. 3. The severe dip around 300 cycles is not a deficiency of the speaker but was due to spurious reflections resulting from the test setup employed. This will be explained later on in this article.

With this improvement to work on, enclosure modification seemed next in order. The first step was to relocate the speaker opening. The sound path distances around the baffle from front to back of the cone of the original cabinet, Fig. 2, were all equal. Dimension A equals dimension B taken anywhere around the baffle face. In the first modified enclosure, as shown in Fig. 4, the speaker opening was moved upward to effect a variation in the distances of the sound wave paths in two directions, from front to rear of the cone. As this drawing illustrates, A_1 , A_2 , and A_3 are of equal dimensions, but are not equal to A , which produces a longer sound wave path. The recessed baffle and other dimensions were unchanged. The curve shown in Fig. 5 gives evidence of considerable improvement over previous measurements.

These results led to further enclosure modification. The recessed baffle was eliminated. The speaker opening was still positioned off-center, but was shifted slightly downward to obtain variations in sound path distances in three directions. Now, as shown in Fig. 6, B and B' are equal, but B , A_1 , and A_2 are all unequal. This modified enclosure, together with the carefully selected loudspeaker as mentioned previously, then met the contract specifications in all ways, providing the required rated output, distortion percentage, and frequency response. This was accomplished with the original amplifier without expansion or modification. The resultant curve is given in Fig. 7, which also shows the specified frequency limits and allowable output level tolerance within the frequency band. It is interesting to add that the additional cost for this chosen speaker over the rejected ones was just \$1.20.

In making an analysis of the conditions as outlined, it is obvious that the amplifier had sufficient gain to do the job but for the inefficiency of the transducer employed. The failing was attributable to both the loudspeaker and its enclosure. The gain of the amplifier was contingent on input level and rated output, this output expressed as a sound pressure level. It follows, therefore, that the output transducer and its housing became a major contributing factor. The rated output was also expressed as the arithmetical average of four different outputs within the specified frequency band, one of these selected frequencies being 1000 cps, and due to the large order inefficiency of the speaker in the 1000 cycle region, the averaged output was reduced to an unacceptable value.

Distortion measurements, taken in the same manner as rated output measurements were, of course, also af-

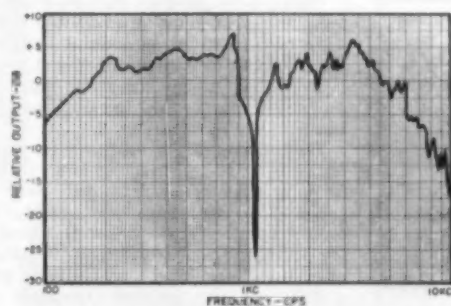


Fig. 1. Measurements made in laboratory anechoic chamber with a moderately-priced 8" speaker housed in the cabinet of Fig. 2. See discussion of test in text.

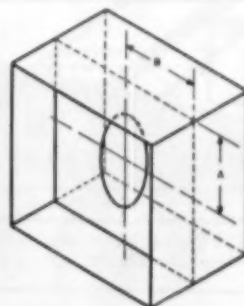


Fig. 2. Enclosure used in running tests charted in graph of Fig. 1.

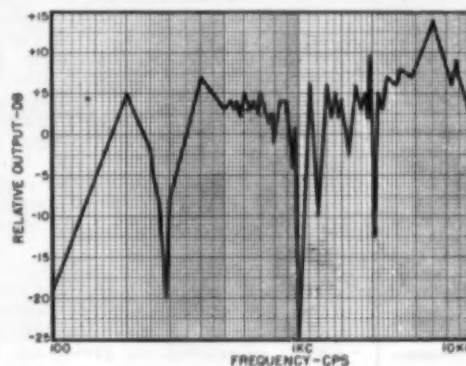


Fig. 3. Response of the "selected" speaker in the enclosure of Fig. 2. Note the improvement in the response at the 1000 cps point. See discussion in text.

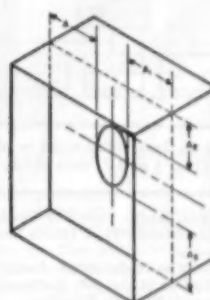


Fig. 4. How test enclosure of Fig. 2 was modified. Speaker opening was moved upward to effect a variation in distances of wave paths.

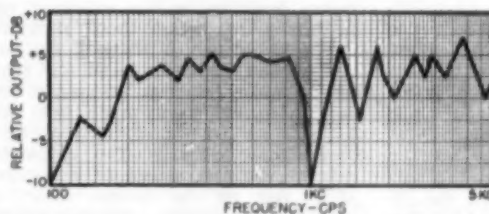


Fig. 5. Improved measurements obtained with the improved enclosure of Fig. 4. Note that 1000 cps dip occurs at -10 db instead of -27 (Fig. 1), -25 (Fig. 3).

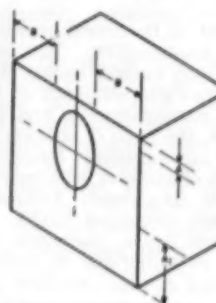
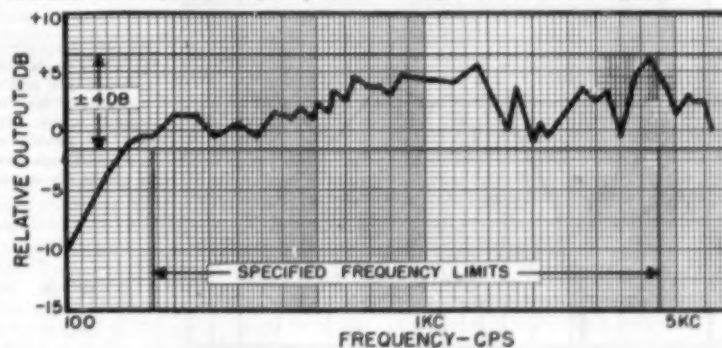


Fig. 6. A further enclosure modification. The recessed baffle was eliminated and the speaker opening, although still off-center as in Fig. 4, was shifted downwards in the front panel to provide additional flexibility in the operation of the "selected" loudspeaker.

Fig. 7. Enclosure of Fig. 6 plus the "selected" speaker gave the required performance within specified frequency limits and output level tolerance required.



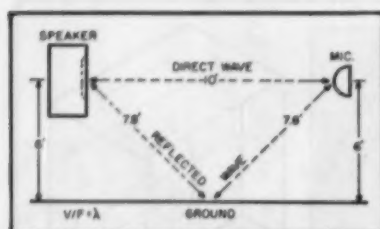


Fig. 8. Factors contributing to the undesirable dip at 300 cps in Figs. 3 and 10.

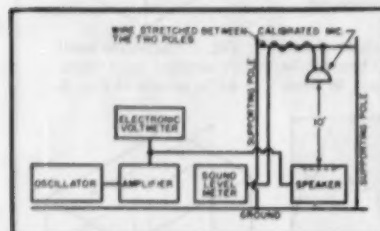


Fig. 9. Test setup used to obtain curves of Figs. 5 and 7, tests made out-of-doors.

General Radio Type 758 Sound Level Meter
General Radio Type 1552-A Sound Level Calibrator
Krohn-Hite Model 430-A Audio Oscillator
Ballantine Model 300 Electronic Voltmeter
McIntosh 20-Watt Amplifier
Kellogg Calibrated Capacitor Microphone
DuMont 304-H Oscilloscope
Hewlett-Packard 330-B Noise and Distortion Analyzer

Table 1. Measuring equipment used by author in making the tests described in article.

fect by the sound pressure output of the loudspeaker. The actual sound pressure output varied with the impedance and efficiency at the different test measurements, and for any test point, the ratio of speaker efficiency at the fundamental frequency to the ratio of speaker efficiency at the harmonic frequencies, influenced the resultant distortion figure. A high distortion figure, therefore, was evident and contributable to transducer inefficiency around the 1000 cycle region.

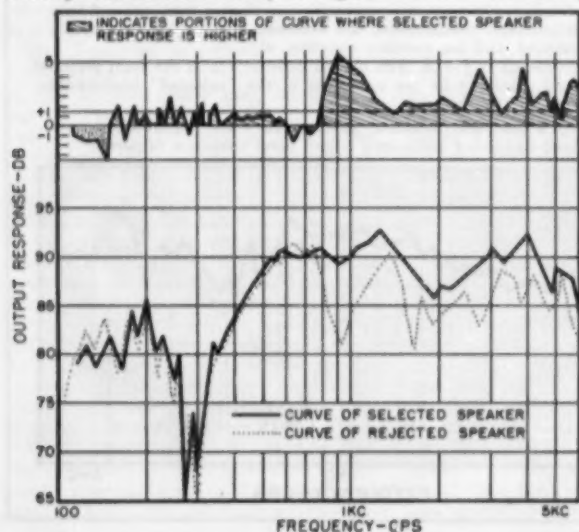


Fig. 10. Comparison between "selected" speaker and one of the best of the "rejected" units. See text for details on test conditions used to obtain the curves.

There is no need to elaborate on the frequency response discrepancy. The deep hole in the area around 1000 cps, as shown by the curve of Fig. 1, gives evidence of the speaker's inability to maintain the curve in the specified limits, as shown in Fig. 7.

The curves of Fig. 10 have no direct bearing on the actual outcome of this project, but were included here to show the comparison between the selected speaker and one of the best of the rejected ones. The tests which gave these two curves were made with a different and smaller enclosure not suitable for this project. The solid curve, of course, shows the response of the chosen speaker, while the dotted curve is for the rejected one. It is to be noted that the rejected speaker response approaches that of the selected speaker from the lower frequency limit of 175 cycles up to slightly over 300 cycles, but the selected speaker is far superior up to and beyond the upper limit of 4500 cps. The graph at the top of Fig. 10 depicts clearly the considerably higher output response, noticeable particularly in the 1000-cycle region, of the chosen speaker.

The complexities of acoustical measurements under less than ideal conditions are great and considerable thought must be given to the test setup. As pointed out previously, the tests of the original speaker and enclosure were made in an anechoic chamber but as these facilities were not available for further measurements described in this article, it was necessary to make these measurements outdoors. A tranquil day and quiet spot away from traffic and other noises were selected. Some of the measurements were made with the loudspeaker positioned horizontally 6 feet above ground. The calibrated microphone was placed at a distance of 10 feet on the speaker axis. As pointed out previously, the hole around the 300-cycle region was due to reflections and is attributable to this particular test setup. This dip around

300 cycles is observed in Figs. 3 and 10, both tests having been made in a similar manner. The factors providing this undesirable condition are clearly indicated in Fig. 8. Here, as shown, the sound path distance of the direct wave on the speaker axis is 10 feet. A reflected wave, following the path from speaker to ground to microphone, travels a distance of 15.6 feet, arriving at the microphone out-of-phase with the direct wave, thus introducing a cancellation effect in this frequency region as can be proven mathematically by the equation $V/f = \lambda$ where V is the velocity of sound in air (approximately 1120 ft./sec.), f is the frequency, and λ is the wavelength of sound in feet.

In other measurements care was taken to be clear of reflecting surfaces to avoid spurious reflections. That this was accomplished can be observed from Figs. 5 and 7 in which there is a complete absence of the hole around 300 cycles. These measurements, which were the final ones accepted, were taken with a long wire stretched between two supports and the calibrated microphone attached to the center of this wire with the opening pointing toward the ground. For measurements at the 10 foot distance the loudspeaker was placed on the ground facing upward toward the microphone. Some two foot tests were made by placing the speaker atop a suitably sized stepladder. It is to be remembered, as Beranek has pointed out, that different response characteristics may be obtained at different distances between the loudspeaker being tested and the microphone due to diffraction around the baffle or enclosure. A block diagram of this test setup is given in Fig. 9.

The signal from the sine wave, low distortion oscillator was fed to the input of the amplifier. The voltage at the output of the amplifier appearing across the loudspeaker voice coil was held constant for each test frequency. Acoustic output of the speaker was then picked up at 10 feet on the speaker axis by the calibrated microphone, the output of which was fed to the sound level meter, a correction factor being applied to the results to account for the long microphone cable employed. See Table 1.

Because of the importance of this project, in order to make certain that no erroneous conclusions had been reached due to less than ideal acoustical test conditions existing in the test setup, the manufacturer of the loudspeaker chosen was asked to repeat the tests in his laboratory, using the identical modified enclosure and loudspeaker. This report substantiated the findings of the design engineers as presented.

REFERENCES

1. Olson, H. F.: "Elements of Acoustical Engineering," D. Van Nostrand Co.
2. Terman, F. E.: "Radio Engineering," McGraw-Hill Book Co.
3. Beranek, Leo L.: "Acoustic Measurements," John Wiley and Sons, Inc.

NARROW-BAND SPEECH UNIT

By J. P. NEIL



Fig. 1. Two views of the speech amplifier built by the author. The holes in the chassis, visible in both views, are drilled at the power-supply end to provide required ventilation when the bottom shield cover is in place. The output socket, J_2 , is located on the top of the chassis between the 6X5 rectifier and the 12AU7 clipper tubes. The pilot light on the top of the chassis is the "fuse" for the power supply as shown in Fig. 2. Refer to text.

AMATEURS as well as the FCC are aware of the problems that have arisen as a result of overcrowding on the amateur bands. This crowding and its resultant QRM, which has plagued the whole fraternity, can be alleviated by adopting the simple narrow-band speech technique to be described in this article.

The author contends that the time has come for a concerted effort on the part of all factions involved to seek a practical solution to this problem. One solution worth serious consideration would be to reduce the present wide speech band of 200 to 3000 cps to approximately 300 to 2000 cps.

The author's experience to date (nearly two years) is that intelligibility is effectively 100 per-cent and unless the contact is notified, they note no degradation other than the effect of a carbon mike. The author has consistently set his carrier between two close stations and been able to get through where formerly contacts were impossible under similar conditions. Needless to say, theoretically, there is some degradation in intelligibility, however, as pointed out, this has not been apparent from the reports received.

Although a bandwidth of 200 to 3000 cps is considered adequate for wide-speech transmission, most amateurs do not limit their speech spectrum and, in many cases, have at least 5 kc. sidebands. Assuming that adjacent carriers are 10 kc. apart, there would be an overlap should their 5 kc. sidebands be exceeded. This would then result in audio frequency hetero-

Details on a method for alleviating amateur QRM by reducing bandwidth of the transmitter without reducing intelligibility.

dyne interference. Assuming the same relative carrier positions, there would not only be no interference but a definite gap between signals were a narrow-band signal placed adjacent to the original.

Suppose we have three carrier signals, each 10 kc. apart, and with 10 kc. sidebands. Since they lie side by side they may interfere if receiver selectivity is poor and if the sidebands are 10 kc. or more. Were the center carrier assumed to be omitted, we could put two 4 kc. narrow-band signals in its place and still have $\frac{1}{2}$ kc. band separation between each of the outer adjacent sidebands, and 1 kc. between the two narrow-bands.

Obviously, if all amateur stations were on narrow-band (especially with clipping) many more stations could occupy the space now allotted or the same number of stations would tend to interfere less with each other.

Practical Application

In order to test these principles, the author built a speech amplifier with a filter limiting speech nominally to the band of 300 to 2000 cps. The author's original article ("Narrow Band Speech Spectrum in Relation to Reduced Channel Crowding," AIEE Miscellaneous Paper 53-144) proposed that the first octave (300 to 600 cps) should be given about a 6 db pre-emphasis or boost.

In lieu of this for amateur purposes, because the peak of speech power is between these latter limits, speech clipping was incorporated instead.

Many contacts were made with both domestic and DX stations, using a crystal microphone and a "Viking II" transmitter. Some stations were advised of the test and some were not. Those not notified made no comment and apparently detected nothing out of the ordinary. Stations asked for comments reported that the quality (as predicted) was not that of normal crystal mikes and somewhat approached carbon mike quality; that conditions permitting, 100 per-cent contacts were made with no difficulty at all in sentence, word, or syllable articulation; that where QRM was bad, the narrow signal could be pulled through and held much more easily than the standard wide-band signals; and on contacts over a 2000 mile hop and put through a phone patch at the far end, listeners could recognize voices.

In view of these favorable reactions, it was felt that a description of the speech equipment used would be of interest to others. This equipment can be used in conjunction with any transmitter now using a crystal or other high-impedance microphone, or adapted to low-impedance types. It is hoped that this article will stimulate sufficient application by the amateur fra-

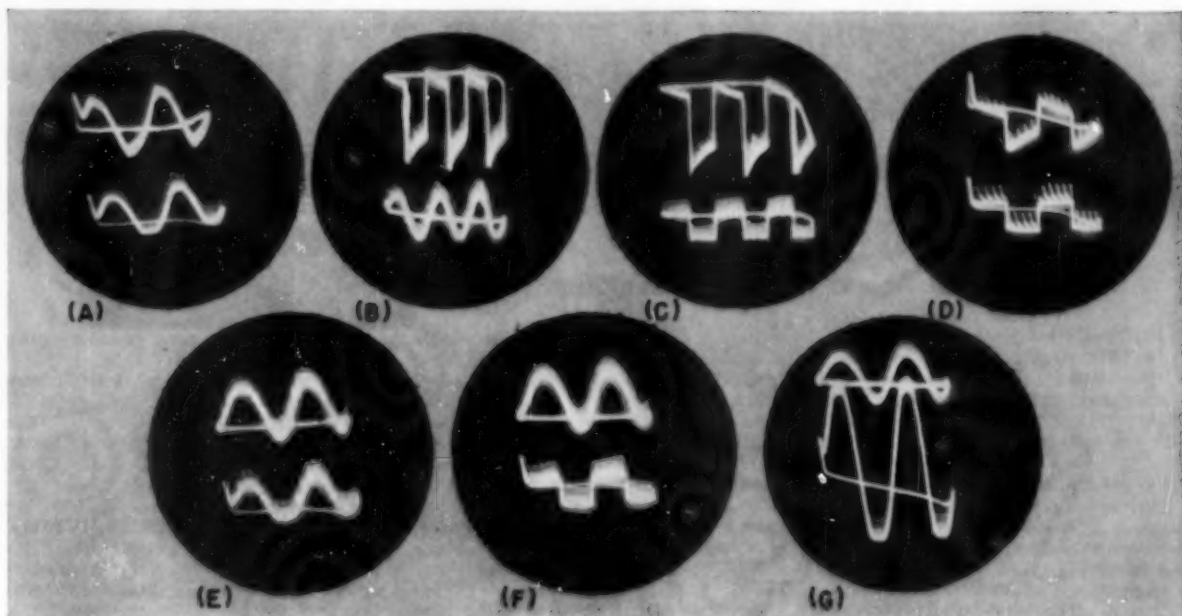


Fig. 4. Oscillographs of the internal characteristics with and without clipping and filtering. (A) Sine-wave input with no clipping or filtering. (B) Sine-wave input with clipping but no filtering. (C) Square-wave input with clipping but no filtering. (D) Square-wave input with no clipping and no filtering. (E) Sine-wave input with clipping and filtering. (F) Square-wave input with clipping and filtering. (G) Sine-wave input with clipping and filtering at .5 volt (10 times normal) input.

It will be noted that Fig. 4D indicates some slight distortion in the input square wave. Note how the filter removes distortion (flattening of sine-wave input and slanting of square waves) and that in Fig. 4G increasing the input voltage ten times does not increase the amplitude of the output trace.

Power Supply

The power supply is of the choke-input type and filtered to give less than .15 per-cent ripple voltage (by actual measurement). As previously mentioned, a shield is used between the power supply and audio sections. A 150 ma. pilot bulb is placed in series with the high-voltage center-tap to act as a "B" fuse. The line switch is separate from the gain control to avoid possible hum pickup.

Operation

Adjustment and test procedures for clipper-filters can be found in various texts, including the "ARRL Handbook" so will not be covered here in any great detail. Briefly, R_a (Fig. 2) is the input gain control with the clipper cut out by means of S_1 or the limiter control with the clipper-filter cut in (that is, it is the control which sets the signal level into the clipper). If the input to the 12AU7 is below the preset clipping level, no change in waveshape takes place (assuming no distortion). Above this level, the tops of the waveforms are flattened but reshaped in the filter as evidenced by Fig. 4. R_{10} is both the output gain control and the filter load.

The output of this amplifier-clipper-band filter unit can be fed into the normal crystal mike input jack of an

existing modulator (using shielded cable) and the correct level then adjusted by means of R_{10} .

The supporting material used in the original AIEE article was illustrated by well-known data from such outstanding acoustic researchers as Fletcher and Munson, Gannet and Kerney, etc. For those readers interested in pursuing this subject in more detail but in relatively simple form, the following inexpensive publications are recommended by the author:

"Frequency Range and Power Considerations in Music Reproduction," *Jensen Technical Monograph No. 5*.

"The Effective Reproduction of

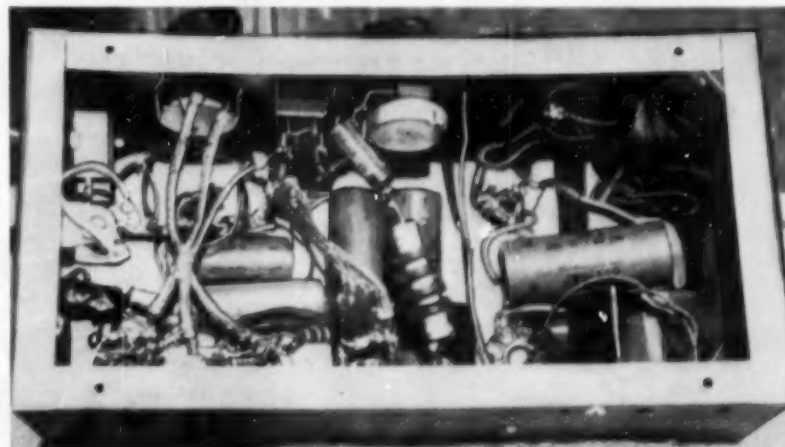
Speech," *Jensen Technical Monograph No. 4*.

Both of these publications are available at most of the well-stocked radio parts supply houses for 25 cents each, or they can be obtained direct from the *Jensen Radio Manufacturing Co.* at 6601 S. Laramie Ave., Chicago 38, Ill.

It is the author's earnest hope that other amateurs will give this circuit a fair trial since, in his opinion, it is a simple and not-too-expensive solution to a problem which all of us know is getting serious. If hams will take a hand in solving this, we stand less chance of "outsiders" stepping in to handle it!

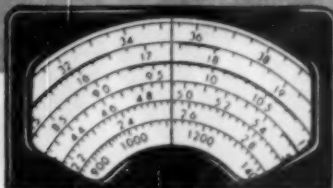
-30-

Fig. 5. Underchassis view of the narrow-band speech unit. The filter choke can be seen in the bottom right-hand corner, mounted at an angle. Note the liberal use of shielded wire and the shield over the bandpass filter input coupling capacitor, C_{10} , as well as its lead, located beside the output r.f. choke. The slightly curved shield partition between the power supply and audio sections is at the right of the r.f. choke. Short leads were considered more important than "neatness" here.





International SHORT-WAVE



Compiled by KENNETH R. BOORD

BEGINNING with this issue of RADIO & TELEVISION NEWS, all time here-in—unless otherwise stated—will be expressed in Greenwich Mean Time (GMT). See footnote at bottom of this page for details.

Radio Club Notes

Austria—Austrian DX-Club, Landgutgasse 41/19, Vienna 10, Austria, at last report had enrolled 134 Austrian and 160 foreign members (latter mostly from USA, Sweden).

Canada—The World Friendship Society of Radio Amateurs has announced the appointment of Norman Duxbury, W1W1Q, 276 New York Ave., Providence, R. I., as its new DX Editor.

Cuba—The ARALV has made available a certificate to radio amateurs and SWL's who have confirmed 7 of the 8 radio districts of Cuba. Either c.w. or phone emission may be used. Applicants must have QSL's from CM/CO 1, 2, 3, 5, 6, 7, and 8. CMO is not a licensing district and CM/CO4 is not considered because of inactivity. Send QSL's to Association of Radio Amateurs of Las Villas, Apartado 136, Santa Clara, Cuba. (WFSRA)

England—In celebration of the 25th anniversary of the International Short Wave Club, London, started in 1929 in the U.S., several special broadcasts have been arranged with various short-wave broadcasters throughout the world during 1955. Broadcasts were

radiated during Feb. by the Swiss Broadcasting Corporation, Radio Monte Carlo, and the Belgian Shortwave Service. Others will be announced from time to time in the DX sessions of Radio Australia, Radio Brussels, Radio Denmark, and through other mediums. Arthur E. Bear, secretary of ISWC, tells me that at the end of the year, ISWC will award prizes for members' reports and comments on these special programs. Congratulations, ISWC!

Sweden—Stig Dahlberg is the new editor of "Nattugglan," house organ of the Scandinavian DX-Club. This club will observe its 10th birthday this month (March). Congratulations and best wishes!

Around the World

Alaska—ALB, 11.530A, Anchorage, Alaska Communications System, good level 1955-2005 testing. (McDaniel, Idaho) ALF, 9.740A, Juneau, noted in Sweden testing 2220. (DX-Radio, Sweden)

Albania—ZAA, 7.850A, poor level

(NOTE: Unless otherwise stated, all time herein is expressed in Greenwich Mean Time (GMT). Subtract 5 hours for EST, 6 for CST, 7 for MST, and 8 for PST. "News" refers to newscasts in the English language. To avoid confusion, the 24-hour clock has been used to designate the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200, while from 1 p.m. to midnight they are shown as 1300 to 2400. The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate).

George Chatfield, Wolcott, N. Y. has been an SWL for about 15 years. He started with a 2-tube battery receiver and has now "graduated" to a National NC-57. He uses a 10-meter dipole and a straightwire. He has logged stations on the short-wave international broadcast and amateur bands in upwards of 125 countries!



starting English news session 2030. (Pearce, England)

Algeria—Radio Algerie, 6.160, closes 2244A with "La Marseillaise." (DX-Radio, Sweden)

Andorra—Radio Andorra, 5.990A, heard in Sweden with some QRM around 1900. (Etersvep)

Anglo-Egyptian Sudan—Radio Omdurman, 4.990AV, noted 1845-1930A closedown; fair strength in N. H. (Hill)

Angola—A new religious broadcaster is "Radio Ecclesia, Emissora Catolica de Angola," 7.260, scheduled 0900-2300. (WRH) Radio Clube de Huambo, 4.850, Nova Lisboa, heard at weak level to 2000 closedown; CR6RI, Radio Diamang, 9.340, Dundo, heard in Sweden 1835-1930 closedown with "A Portuguesa." (Nattugglan) Radio Clube de Huila, 5.022, Sa da Bandeira, rather good but in heavy CWQRM to 2030 closedown. (Mercier, France) CR6RE, 7.244, Radio Clube de Malange, logged in Britain around 1805 and later around 1930, usually S3-4. (ISWL, England) Radio Clube de Cuanza Sul, Novo Redondo, 7.805, heard in Sweden to 1945. (Etersvep) CR6RC, 11.862, Luanda, excellent 2050 with classical music, identified in Portuguese; only slight heterodyne on channel. (Cox, Dela.)

Argentina—Radio del Estado, LRAI, 9.690, Buenos Aires, noted at fine level 0500-0600 with classical music. (Adam, B. C.)

Australia—When this was compiled, Radio Australia had moved VLB9 from 9.540 back to 9.615 for the 1200-1345 Eastern North American transmission, and was using VLA11 on 11.760 for the Western North American beam 0255-0415. VLB11, 11.900, noted to India, Pakistan, Burma 1715-1730 closedown; VLM4, 4.920, Brisbane, Queensland, heard 0800-0930, reports Esser, Pa. The 9.500 channel is a brilliant signal in West Virginia around 0800; has DX session Sun. 0840.

Austria—Blue Danube Network, 9.617, Salzburg, heard in Sweden QSA2-3, QRK-3, with QSB, 0800-1400. (Nattugglan)

Bahamas—Telecommunications Department, Nassau, noted testing on 4.850A at 1215. (Morris, Ohio)

Bechuanaland—ZNB, 8.244A, Mafeking, heard in Sweden 1900, QSA2-3, QRK2-3, CWQRM. (Nattugglan)

Belgium—ORU, Brussels, sent pretty QSL card. (Stenson, Sweden) Noted with English to North America 0100-

(Continued on page 153)

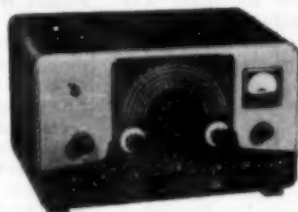


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By
CLARK JACKSON

Front view of the new 20-watt amplifier-preamp developed by The Radio Craftsmen.

Technical details on an amplifier-preamp-equalizer that is a complete "system" with addition of disc changer and speaker.

COMBINING a preamplifier-equalizer with a power amplifier into a single unit has not always resulted in over-all performance satisfactory for the most critical applications. While it is true that 100 per-cent flexibility of design in the "cost-no-object" type of custom equipment can be prohibitive, many features of this type of installation can be maintained through integrated engineering which eliminates duplication of components.

Among the desirable features for this type of unit are: adequate power output at low distortion, minimum distortion in all circuits (not just in the power amplifier), flexible phono equalization, rumble and noise reduction filters, loudness controls which can be removed from the circuit, and attractive styling and finish.

The power rating of the amplifier section of the unit which evolved from these design criteria is 20 watts. While a 10-watt amplifier has long been considered adequate for normal home installations, the reserve power level offered by 20 watts is useful in many installations which use either inexpensive speakers or some of the new types of high-fidelity speakers which have been designed primarily for low cone resonance and low distortion. With either of these types of speakers the efficiency is lower than that found in the usual hi-fi type of speaker, thus reserve amplifier power is needed. The operating distortion at low power levels can be considerably reduced with this unit as compared with a 10-watt amplifier.

While few units in any price range have included built-in noise elimination filters, the desirability of such a feature is evident as an ultimate measure of control. Since tape recording has grown so popular, the usefulness of high- and low-end filters for record-

ing purposes cannot be over-emphasized. Because of this, a departure from previous practice has been included in the "Solitaire" recorder output whereby the advantage of using the filters is maintained through this output. This feature gives the tape recordist several advantages. First, the low-end, 40-cycle cut-off filter should be used at all times when making recordings in order to eliminate any trace of subsonic rumble appearing at the tape recording head. This rumble magnetizes recorder heads which is the principal source of the increasing level of distortion in tape recorders after considerable usage. Use of this 40-cycle filter eliminates this tendency toward head magnetization in addition to producing cleaner tapes by preventing tape overload from low-frequency noise components below 40 cycles.

The use of high-end filters to remove noise when recording from discs or AM broadcasts will also result in much cleaner tapes. High-end filters are certainly a necessity for anyone who wishes to record older 78 rpm discs onto tape. In addition to these filters, tone control correction is also available on the tape output and since few tape recorders offer anything but the simplest of tone controls, this enables the recordist to balance incoming program material before recording.

The power amplifier incorporates a pair of 6L6 output tubes driven from a phase splitter. This type of design has been proven in many thousands of commercial amplifiers. The 18 db of feedback is taken from the secondary of the output transformer and fed back to the first voltage amplifier stage. This degree of feedback results in good frequency response and very low distortion at all operating levels. The output transformer has been carefully designed for a high degree of

stability under feedback conditions and, particularly, to minimize high-order, high-frequency distortion which often occurs in transformers at power levels over 5 watts.

Three separate stability-correcting networks are used, one in the plate of the first amplifier stage, a capacitor across the feedback resistor, and, finally, a frequency-discriminating load directly across the secondary of the output transformer.

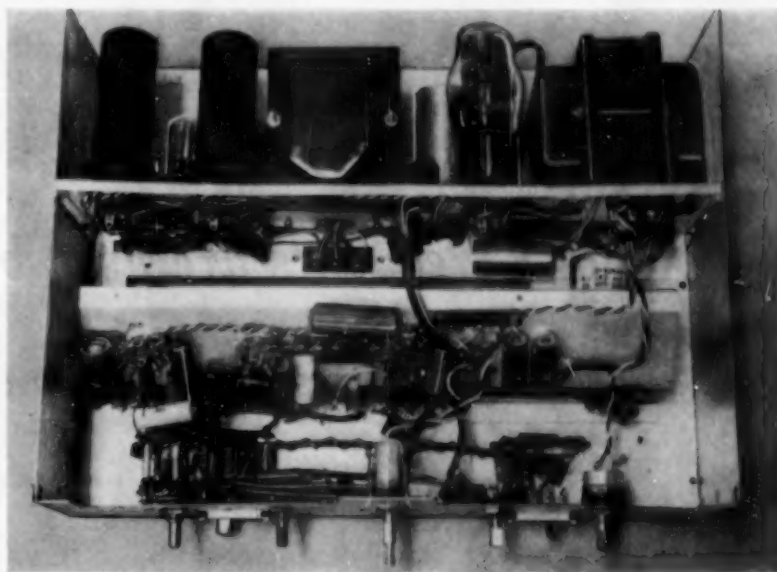
The high- and low-end filter circuits are of the feedback type, two 6 db-per-octave turnovers are combined within the feedback loop to produce the final 12 db-per-octave slope. The over-all feedback is used to control the sharpness of the initial turnover since without feedback two RC turnovers which have an ultimate 12 db-per-octave slope have a very gradually-rounded turnover. The filter circuits are inserted in the feedback pair audio amplifier and are actuated by three-position slide switches. The turnover of the 40-cycle filter has been softened somewhat to compensate for tone arm resonance found in most record changer type arms. This type of curve eliminates the peak in the vicinity of 30 cycles, which many changers exhibit. The 150-cycle cut-off point is for the purpose of eliminating noise, rumble, and hum which may be found in older records. Two high-frequency positions are provided at 3 kc. and 6½ kc. The 6½ kc. position can be used to eliminate distortion found in the 10 kc. region of some LP's. The 3 kc. position is primarily for reduction of noise on older or scratchy records and on AM reception.

The tone controls provide 13 db of cut and 15 db of boost at 50 and 10,000 cycles. The tone control circuit is inserted at the input of the audio amplifier and since it is a passive network, contributes no distortion. The loudness control consists of two sections, an input level-set which precedes the tone controls and a loudness compensation section which is driven

from a cathode follower and feeds the power amplifier. In use, the level-set is used to set the over-all system gain for the phono cartridge, particular speaker resonance and room acoustics of a given installation. The compensation provided follows the Fletcher-Munson characteristics closely and compensates for a range of 40 db. If loudness compensation is not desired, the level-set control may be used as an ordinary volume control.

The preamplifier provides equalization for all of the popular recording curves. High- and low-end equalization is combined in a single switch. The preamplifier section uses feedback-type turnover equalization. Low-noise resistors and selected low-leakage capacitors are used in this circuit to minimize noise. The heaters of the audio tubes are biased above ground and the hum potentiometer is connected across the heater winding to correct for variations in tubes. As a result, the hum and noise is better than 65 db down on phono and better than 75 db down on the other input channels. Besides the phono input, three other inputs are provided for tuners, tape recorders, etc. High-output cartridges, such as crystals, may be connected into these inputs.

All input and output connections



Under chassis view showing the three subassemblies to facilitate servicing.

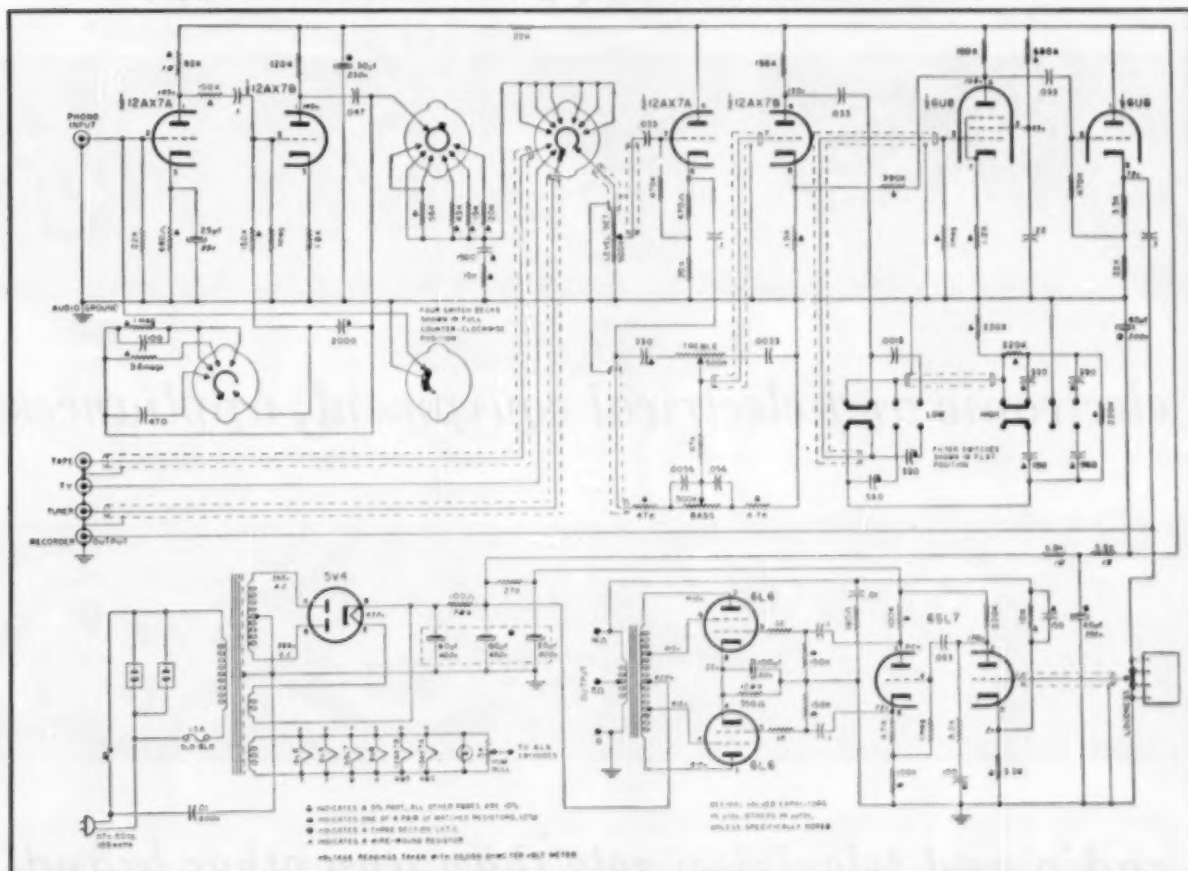
have been brought in under the unit rather than at the back which contributes to shorter audio leads thus making extended frequency response easier. In addition, when used on a table top, the incoming and outgoing leads

lie flat and are more easily concealed.

Because of the small size of the unit—it measures 4" high, 10½" deep, and 14½" wide—the "Solitaire" is easily placed on a bookshelf, on a mantelpiece, or on a table top.

-30-

Complete schematic diagram of the Craftsman C-250, 20-watt amplifier-preamp-equalizer unit, the "Solitaire."

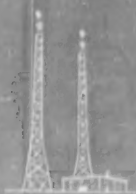




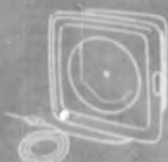
More IRC resistors are used by manufacturers



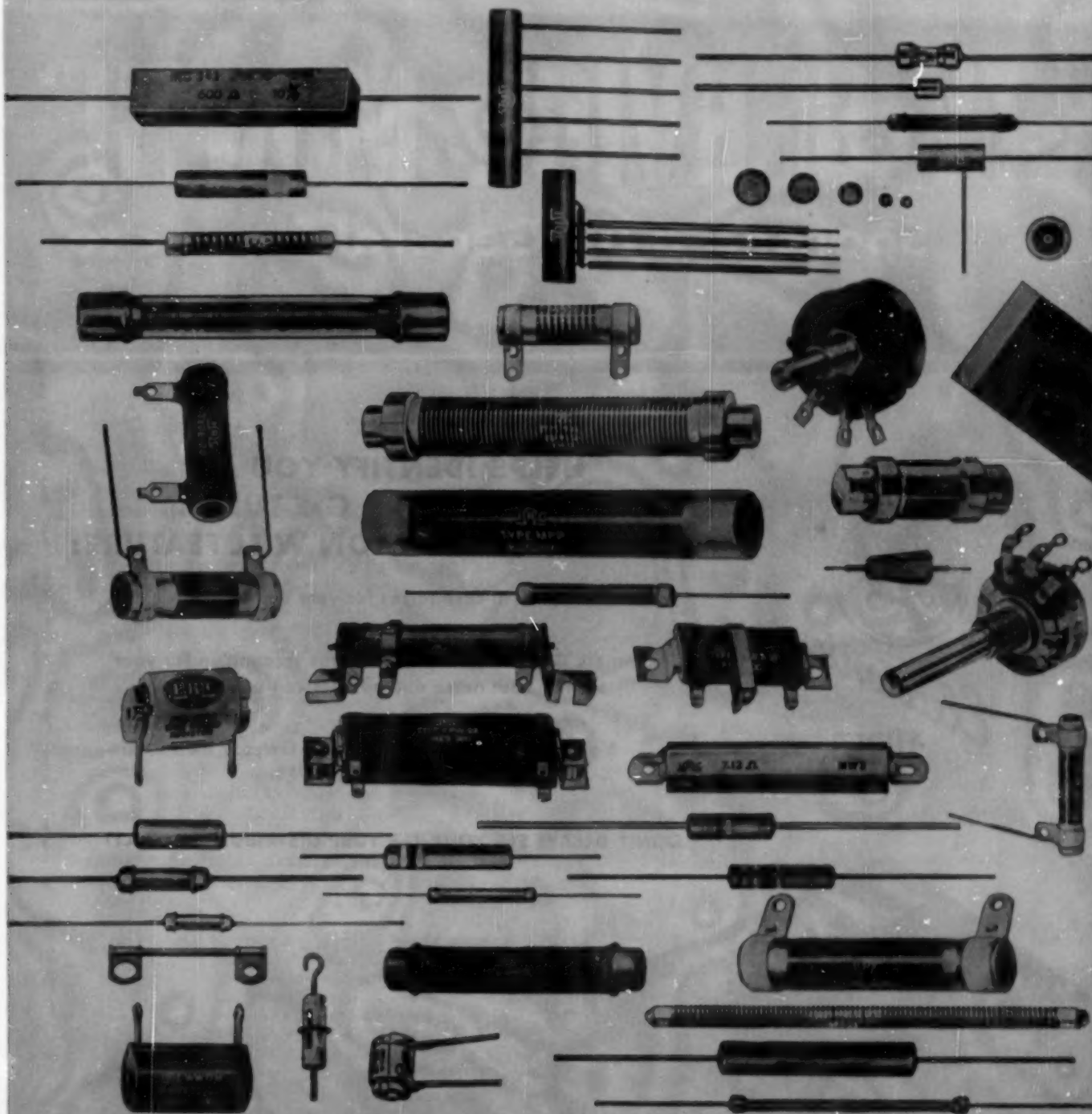
of military devices, instruments, computers,



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radio and television sets than any other brand.



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And here's sensational news! Your name and address can appear in G. E.'s announcement in LOOK—in subscribers' hands and on the newsstands April 19. You can be part of the industry's greatest public-relations program to date. 20,000,000 people see LOOK. It's read in homes all through your neighborhood.

See your G-E tube distributor immediately so your name may be included! In order to spark sales still more, your G-E distributor has ready for you a big kit of unique promotion items—each new, different, a winner. Read about some of them at right . . . then see or phone your distributor today! Tube Department, General Electric Company, Schenectady 5, New York.



You too can display this colorful window emblem! Pinpoints your shop as Contest and TV Service Month headquarters.



Large window streamer. Use it to announce a special attractive TV Service offer that will turn callers into buyers.



Footprints—plastic, self-stick—for sidewalk before your door. They invite customers in!



Talking postcard . . . brand-new, it's a record that actually plays on TV owners' phonographs! Also, regular advertising postcard. Both tell story of prize contest—help you promote TV Service Month profitably.

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HIGH PASS FILTER eliminates TV interference

The model 114-330 High Pass Filter is an inexpensive accessory providing clearer, sharper pictures for any tv set.

It effectively rejects all signals at frequencies below 50 mc, including communication-type, diathermy and heat-transmitting interference, and industrial or ignition interference • Circuits are double-shielded in the 114-330 to prevent pick-ups of signals by the Filter itself. Mounting/grounding strap bleeds off rf interference direct to chassis ground. Easily attached to chassis of any tv set.

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AMPHENOL

"COMPACTING" THE DIPOLE

By R. H. MITCHELL, W6TZB

Solution to the problem of operating on 3.5, 7, and 14 mc. at cramped urban locations.

AS A great many city-dwelling hams have found, the average urban lot isn't large enough to support a full-sized low-frequency (3.5 or 7 mc.) dipole. One solution to the problem consists of swinging one leg of the dipole around so that the antenna forms a "V" with a 90 degree apex angle, as shown in Fig. 1A. This materially reduces the space required for a low-frequency dipole. We tried this antenna, using legs 66 feet long, and fed it with tuned feeders for all-band operation. The antenna worked quite well. No directional effects were noticed on the 3.5 and 7 mc. bands, which is in accordance with theory. Terman states that this antenna should be virtually omnidirectional in the horizontal plane.¹ On 14 mc., the antenna was somewhat directional along the bisector of the "V", and on 28 mc., this directivity became marked.

An even more compact antenna is the half-wave loop, shown in Fig. 1B. We put up one of these antennas for 7 mc. inside the living room of a second-floor apartment. The antenna was resonated with a grid-dip oscillator and the correct length for 7.1 mc. was found to be 65 feet. Performance on 7 mc. was good and the standing-wave ratio was fairly low when the loop was fed with 52-ohm coaxial cable. One reference² states that this antenna has a front-to-back ratio of 4 to 6 db and that in the optimum direction, field strength is about 1 db below that of a half-wave dipole in its optimum direction. As an experiment, the antenna was fed from the centers of each of the four sides, but no particular directional effects were noticeable. Subsequently, a 300-ohm twin-lead line was substituted for the 52-ohm cable, in order to permit operation on the 14 and 28 mc. bands. This line was 27 feet, 10 inches long, an electrical quarter wavelength at 7 mc., and the feeders were tuned. The antenna was still good on 7 mc., performed fairly well on 14 mc., but was very poor on 28 mc.

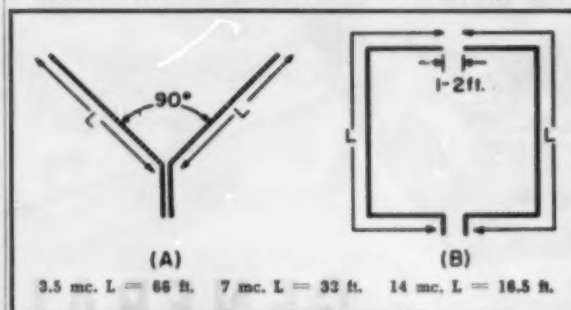
This antenna, like any other, will perform better if erected outdoors and in the clear. The principal advantage of the half-wave loop is that it requires four supports. However, being able to put an efficient 3.5 mc. antenna into a square 34 feet on a side should more than overcome this disadvantage for the ham with little space.

REFERENCES

1. Terman: "Radio Engineering," Third Edition, p. 722.
2. "The ARRL Antenna Book," 1949 Edition, p. 63.

-30-

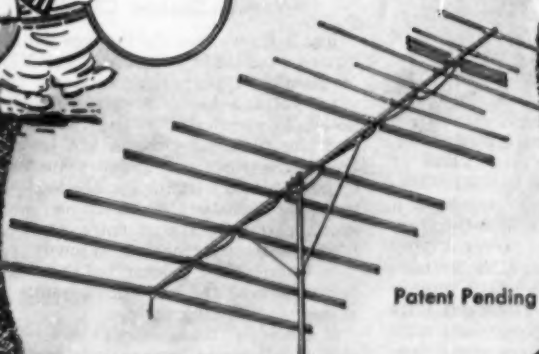
Fig. 1. (A) One solution to the problem of shrinking a dipole to fit minimum space. (B) Top view of half-wave loop. Length of L will be approximately the same as for L in (A). Some shortening effect may be noticeable because of this folding operation.



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America's

**LEADING
ANTENNAS**

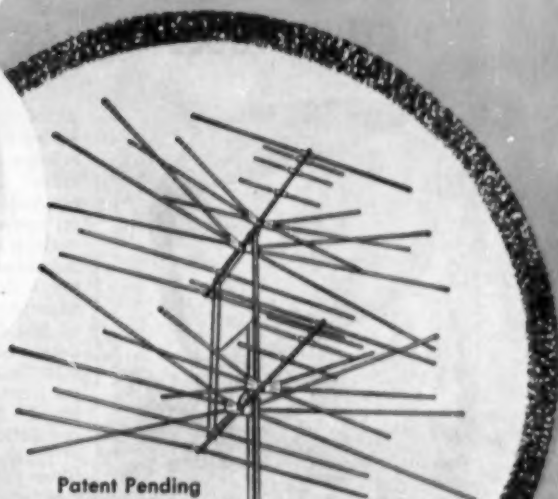


REAR GUARD
For Pin Point
Reception

For the best in televiewing pleasure America's TV audience looks to Kay-Townes Antennas. The pace-setting **BIG JACK**, originated and patented by Kay-Townes, leads in sales across the nation. In fringe and problem areas the **SUPER KATY** has become a "proven performer" giving top-quality pictures where good reception had been next to impossible without it.

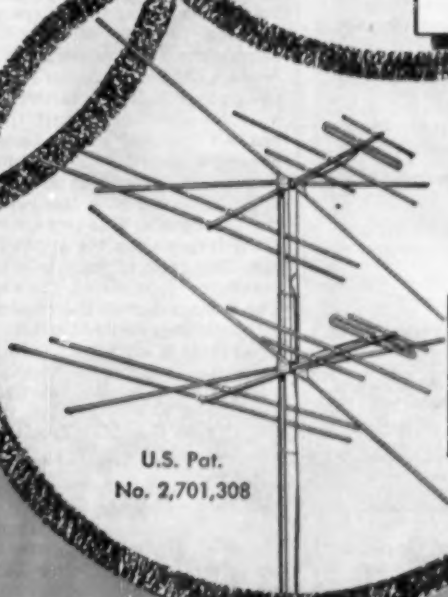
And now Kay-Townes is first again with the answer for TV fans living between two powerful stations. The Kay-Townes **REAR GUARD** refuses signals from the rear to give pin-point directivity and photo-clear reception in areas where reception has been practically impossible because of interference from near-by stations.

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A Proven
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Low resistance of outside conductive coating minimizes radiation of horizontal oscillator sweep frequency.

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Rigid control of internal conductive coating provides utmost service reliability.

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You Can Build a Reputation On Tung-Sol Quality

1250 VOLT D.C. POWER SUPPLY

By
JESSE JACOBSON

Details on a resonant 60 cps circuit used to obtain a high voltage which is then rectified in voltage doubler circuit.

CONVENTIONAL methods of obtaining high-voltage d.c. used to supply beam current to cathode-ray tubes include: flyback circuit, r.f. power supply, pulse-type power supply, or a step-up power transformer.

Each of these methods has its own individual advantages and disadvantages, depending on its application. For example, the power transformer method has the advantage of simplicity of design but is disadvantageous from the standpoint of weight and safety. The poor safety factor is due to the combined effects of the excellent voltage regulation of power transformers operating at 60 cps and the large value of filter capacitors needed to filter low-frequency ripple. In other words, if a person accidentally touches the terminals of a high-voltage power supply using a power transformer, the voltage output of the transformer will remain substantially constant. However, it is possible to obtain comparatively high voltage d.c. from the 60 cps power line without the use of a power transformer for step-up purposes. This increases the safety factor. The circuit is shown in Fig. 2. Operation is based on a series-resonant circuit tuned to 60 cps. An iron core coil is tuned to resonance by means of a capacitor. When the circuit is tuned to 60 cps, a voltage appears across both the capacitor and the inductance. This voltage is substantially larger than the applied line voltage. The ratio of voltage across either reactance depends on the circuit "Q." The voltage across the capacitor is fed into a voltage doubler and then filtered. The result is an output voltage of 1250 volts d.c., capable of supplying beam current to an oscilloscope CRT.

The LC Circuit

The LC circuit which is tuned to the line frequency consists of an iron core coil, L , such as the primary of a small speaker output transformer, tuned with a capacitor, C , having a capacity depending on the inductance of the coil. The capacity needed to tune the coil may be determined as follows:

1. Connect the coil and a .1 μ f., 1500 v. capacitor as shown in Fig. 1.
2. Connect a v.t.v.m. or high-resistance a.c. voltmeter across C .
3. Plug circuit into a.c. line and read voltage across C .
4. Add as many .1 μ f. capacitors in parallel as needed to produce maximum voltage across C . The circuit will then be tuned to 60 cps.

Incidentally, a small a.c.-d.c. type

filter choke may be tried instead of the output transformer. However, experimentation will determine the most satisfactory inductance depending on the amount of voltage obtained, as covered in step 4. Experiment with various inductances until resonance produces approximately 460 volts a.c. r.m.s.

Voltage-Doubler Circuit

Fig. 2 shows that the voltage-doubler circuit consists of two diodes (1B3GT's or similar types) connected as full-wave voltage doublers. Since filament power is required for the two diodes and the filament circuits are isolated from each other, a filament transformer having two windings is needed. This may be constructed from a small speaker output transformer or small filament transformer as follows:

1. Connect the primary of the transformer across the line and measure the secondary winding voltage.
2. Remove transformer from line circuit. Remove laminations and un-

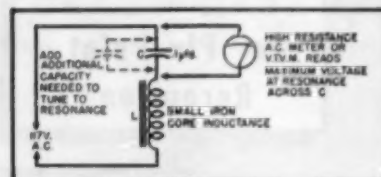
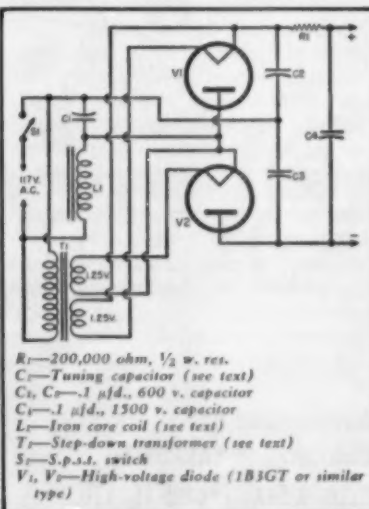


Fig. 1. Means of tuning circuit to resonance.

Fig. 2. Circuit diagram of the 60-cycle resonant-circuit power supply. The circuit is limited to low current drain applications.



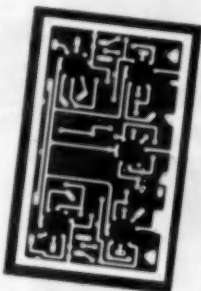
NEW 1955

Heathkit

Engineering Features

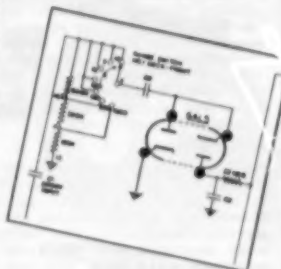
New PRINTED CIRCUITS

One of the many tremendous improvements in the new 1955 Heathkits is the use of an etched metal process printed circuit board. Printed circuits will be used in Heathkits whenever they will affect construction simplification, performance stabilization, and lend themselves to instrument design. Now for the first time a kit instrument company offers the advantages of modern printed circuit instrument construction technique. For the first time consideration has been given toward reducing kit assembly time. Also this is the first time that printed circuit boards have been hand soldered on a volume basis. Offered only by Heathkit, the pioneer and leader in kit instrument design.



New PEAK-TO-PEAK VTVM CIRCUIT

New 6AL5 full wave rectifier in AC input circuit permits full scale peak-to-peak measurements. Seven ranges — upper limits 4000 volts peak-to-peak. Just the thing you TV servicemen have needed in making TV circuit voltage checks. Precision resistor voltage divider limits AC RMS level to 150 volts. Prevents overloading the rectifier—extends upper limit AC RMS ranges to 1500 volts—further protects meter and circuitry against AC flash-over or arcing. Another definite example of continuing Heathkit design leadership in the kit instrument field.



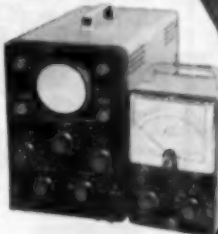
New HIGH READABILITY PANELS

New 1955 Heathkits feature complete panel redesign. Sharp white lettering applied to the beautiful charcoal gray panels, provide a new high in readability. Lettering is easy-to-read open style and panel calibrations are vividly clear against the pleasing soft gray background. New knobs of exclusive Heathkit design.



New 3" UTILITY SCOPE

The new 3" Scope is a "natural" for the well rounded line of Heathkit instruments. Small in size, 11 1/4" deep, 6 1/2" wide, 9 1/2" high, yet big in performance. Just think of the value: an Oscilloscope for \$29.50. Brilliant intensity, sharp focusing, wide positioning range. An ideal portable Scope for the TV serviceman—a second shop scope—modulation monitor for you hams (deflection plate terminals in rear of cabinet). Performance to spare for all general scope applications. See specifications on following page.

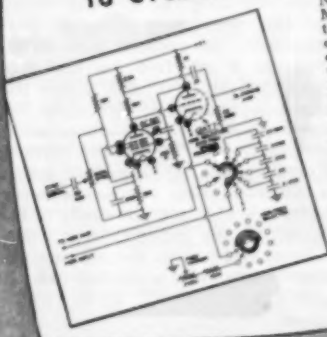


New STYLING New COLOR

New styling and coloring is responsible for tremendous improvement in Heathkit appearance. The new instrument panel color combination is high definition white lettering in a soft charcoal gray panel. Cabinet color is a lighter leather gray. The satin gold baked enamel cabinet for the WA-12 Pre-amplifier is further indicative of the modern patterning trend in Heathkit styling.

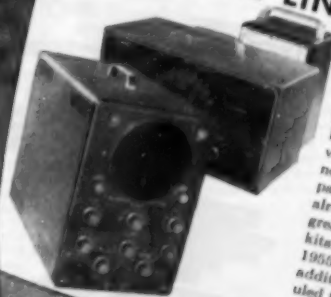


New SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC



New 1955 Heathkit Model 0-10 Scope features a new wide frequency range sweep generator covering 10 cycles to 500,000 cycles. This coverage is available in five virtually decade sweep ranges and is five times greater than the sweep frequency range usually available. Excellent retrace time characteristics, actually less than 20% at 500 KC. Use of the free running Heath circuit provides a larger margin of stability and a new high in Heathkit Scope performance.

Continuing PROGRESS FUTURE LINE EXPANSION



The outstanding improvements featured in the 1955 Heathkit line are representative of the progress characterized by the Heath Company operation. Long range planning will provide a continuing succession of new kit releases to further expand the Heathkit line which already represents the world's greatest selection of electronic kits. The innovations in the 1955 line, are representative of additional new models scheduled for release for the coming years.

SEE THE INSTRUMENTS
ON THE FOLLOWING PAGES

HEATH COMPANY • Benton Harbor 15, Mich.

Heathkit ELECTRONIC SWITCH KIT

The basic function of the Heathkit Electronic Switch Kit is to permit simultaneous oscilloscope observation of two separate traces which can be either separated or superimposed for individual study. This is accomplished through the use of two individually controlled inputs working through amplifier, multi-vibrator, and blocking stages. The output of the Electronic Switch is connected directly to the vertical input of the Oscilloscope. A typical example of usefulness would be simultaneous observation of a signal or waveform as it appears at both the input and output stages of an amplifier.

APPLICATIONS

An Electronic Switch has many applications to increase the over-all operating versatility of your oscilloscope. It can be used to check amplifier distortion—audio crossover networks—phase inverter circuits—to measure phase shift—special waveform study, etc. The instrument can also be conveniently used as a square wave generator over the range of switching frequencies, often providing the necessary wave form response information without incurring the expense of an additional instrument. Ownership of this instrument will reveal many entirely new fields of oscilloscope application and will quickly justify the modest cost of the Electronic Switch Kit.

Individual input gain control, position control, coarse frequency control, and fine frequency control.

Transformer operated for safety when used in conjunction with other equipment.



MODEL 5-2

\$23.50

Shpg. Wt. 8 lbs.

Telecomplement: 1-8X3
Continuously variable switching rates in three ranges from less than 10 CPS to over 2000 CPS.

Heathkit VOLTAGE CALIBRATOR KIT



MODEL VC-2

\$11.50

Shpg. Wt. 4 lbs.

Another useful oscilloscope accessory particularly in circuit development work and in TV and radio service work. The Voltage Calibrator provides a convenient method for making peak-to-peak voltage measurements with an oscilloscope, by establishing a relationship on a comparison basis between the amplitude of an unknown wave shape and a known output of the voltage calibrator. Peak-to-peak voltage values are read directly from a calibrated panel scale without recourse to involved calculations.

FEATURES:

To off-set line voltage supply irregularities, the instrument features a voltage regulator tube. A convenient "signal" position on the panel switch by-passes the calibrator completely and the signal is applied through the oscilloscope vertical input, thereby eliminating the necessity for constantly transferring test leads.

RANGES:

With the Heathkit Voltage Calibrator it is possible to measure all types of complex waveforms within a voltage range of .01 to 100 volts peak-to-peak. Build this instrument in a few hours and enjoy the added benefits offered only through combination use of test equipment.

Heathkit LOW CAPACITY PROBE KIT



No. 342

\$3.50

Shpg. Wt. 1 lb.

An oscilloscope accessory, the 342 Low Capacity Probe permits observation of complex TV waveforms without distortion. An adjustable trimmer provides proper matching to any conventional scope input circuit. Excellent for high frequency, high impedance, or broad bandwidth circuits. The attenuation ratio can be varied to meet individual requirements.

Heathkit SCOPE DEMODULATOR PROBE KIT



No. 337-C

\$3.50

Shpg. Wt. 1 lb.

Extend the usefulness of your oscilloscope by observing modulation envelopes of RF or IF carriers found in TV and radio receivers. The Heathkit Demodulator Probe will be helpful in alignment work, as a gain analyzer and a signal tracer. Easy construction with the new modern printed circuit board. Voltage limits are 30 volts RMS and 500 volts D.C.

HEATH company

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wind all secondary turns, counting turns as they are removed.

3. Wind two separate filament windings, insulating the two windings from each other and from the primary. Wire size should be about #26 gauge to handle the 0.2 amperes drawn by each 1B3 rectifier tube. The number of turns to be wound for each of the two windings is equal to the number of turns counted in Step 2 multiplied by 1.50 and divided by the value of the secondary voltage as measured in Step 1.

4. Replace the laminations.

The Filter Circuit

The filter circuit consists of a 200-ohm filter resistor and a .1 μ f. filter capacitor. The ripple frequency is equal to 120 cps and a practically pure d.c. output voltage will be obtained across the .1 μ f. filter capacitor. C_1 , C_2 and C_3 are charged to the peak voltage on the positive and negative peaks delivered by their respective diodes. Since the input voltage to the diodes is equal to 460 volts r.m.s., the peak voltage of this value is doubled and appears as a value of 1250 volts d.c. (unfiltered) across C_1 and C_2 .

The possibility of severe personal injury is small with a circuit of this type as compared to the transformer-type power supply operating on 60 cps. Excessive circuit loading of the resonant-type power supply results in lowered output voltage with subsequent decrease in the possibility of personal injury. Circuit loading that occurs due to bodily contact lowers the "Q" of the tuned circuit which is a decided advantage over the step-up transformer type power supply.

Operation of Tuned Circuit

Assume that an iron core coil having an inductance of 20 henrys has been chosen with a "Q" of 4. A capacitor having a value of .35 μ f. will be needed to tune the coil to 60 cps. When the coil and capacitor are connected in series across the 117-volt a.c. line, the current flow through the circuit will be in-phase with the line voltage and will attain a value equal to 60 ma. The effective circuit resistance is 1884 ohms including the d.c. coil resistance and the core losses since $R=2\pi/L/Q$. Therefore, the current flow of 60 ma. produces a reactive voltage drop of approximately 560 volts across the capacitive reactance of 7600 ohms. Higher reactive voltage drops are possible depending on the "Q" of the inductance. However, high "Q" iron core coils such as filter chokes, output transformer primaries, etc., are not easily obtained. Therefore, the experimenter will have to be content with the voltage output mentioned unless a special inductance having a higher "Q" at 60 cps is obtained.

Voltage Regulation

Fig. 3 shows how the voltage output of the series-resonant power supply is affected as the load current is changed. When 200 μ a. is drained the output

RADIO & TELEVISION NEWS

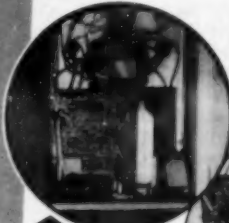
NEW *Heathkit* 5" PUSH-PULL OSCILLOSCOPE KIT FOR COLOR TV

BRAND NEW DESIGN: The new Heathkit Model O-10 Oscilloscope would be something special at any price, but is almost unbelievable at \$69.50. Completely re-designed scope has broadband amplifiers for color TV work and offers brilliant overall performance. Vertical frequency response within 5 db from 5 cps to 5 mc. Even more astounding, the response is down less than 1 1/2 db at 3.58 mc. the color TV sync burst frequency. It is essential that scopes for color work have these broadband characteristics.

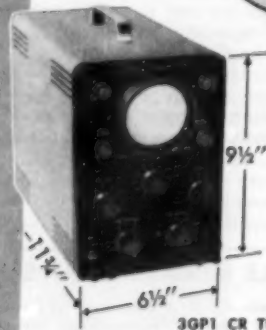
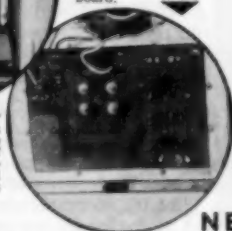
PRINTED CIRCUITS: Two printed circuit boards used in this fine instrument to insure stable, consistent performance. Problems solved by pre-engineering of boards, and their use guarantees completed unit that will have same characteristics as lab development model. Printed circuits simplify construction and save labor.

NEW SWEEP CIRCUIT: Sweep circuit operates with exceptionally good linearity from 20 cps to over 500,000 cps, 5 times the usual range for scopes in this price range. An entirely new circuit introduced for the first time in any Heathkit.

Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single printed circuit board.



Clean, open, under chassis construction and wiring. Possible only through use of pre-cabled wiring harness, and simplified printed circuit boards.



NEW *Heathkit* 3" PRINTED CIRCUIT OSCILLOSCOPE KIT MODEL OL-1

\$29.50 Shpg. Wt. 15 lbs.

New easy-to-build printed circuit board with high insulation factor.

New Heathkit instrument styling—charcoal gray panel with high readability white lettering.

New Heath twin triode sweep generator 15-100,000 cycle sweep.

New compact utility Scope—light-weight—portable for service work.

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

EXCEPTIONAL VALUE: The brand new Model OL-1 Utility Oscilloscope is designed especially for portable applications so that outside servicemen or persons performing field tests can have the advantages of a scope available. Then too, it is ideal for home workshop, the ham shack, or as an "extra" scope for the service shop. It is compact, light in weight, and surprisingly versatile in operation. An outstanding instrument for the price.

Front panel controls are "bench-tested" for ease of operation and convenience. Printed circuit board used for constant circuit performance. Assembly time cut in half!

SPECIFICATIONS: Vertical amplifiers feature frequency response within 1 db from 10 cps to 100 kc, and within 5 db from 5 cps to 300 kc. Vertical sensitivity .2 volts per inch at 1 kc, with input impedance of 12 mmsd shunting 10 megohms.

Horizontal response within 1 db from 10 cps to 200 kc, and within 5 db from 5 cps to 500 kc. Hor. sensitivity .25 volts per inch at 1 kc, input impedance of 15 mmsd shunting 10 megohms. Sweep generator covers 10 cps to 100,000 cps with stable positive lock-in circuit. Cathode follower input in both vert. and hor. amplifiers; push-pull vertical and horizontal deflection amplifiers; 3" CRT; electronic positioning controls for wide range of vertical and horizontal spot deflection; provision for internal and external sync; 60 cycle line sweep. New modern color styling and unusual performance make this instrument an outstanding value.

First color television service Oscilloscope with necessary high sensitivity and full 5 megacycle bandwidth.

New printed circuit construction. All components mounted on high insulation surface resulting in uniformly low circuit capacities.

New type wide frequency range Heath sweep generator 10 cycles to 500,000 cps.

New electronic positioning controls for instantaneous, definite positioning without bounce or overshoot.

New SUP1 CR tube



New cabinet styling and color harmony—charcoal gray panel with high readability white lettering.

MODEL O-10

\$69.50

Shpg. Wt. 27 lbs.

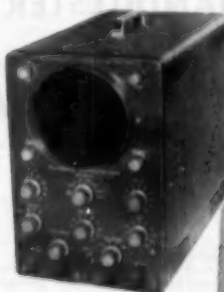
NEW *Heathkit* 5" PRINTED CIRCUIT OSCILLOSCOPE KIT MODEL OM-1

\$39.50 Shpg. Wt. 24 lbs.

VERSATILE INSTRUMENT: The new Model OM-1 general purpose Oscilloscope represents an outstanding dollar value in reliable test equipment. Full 5 inch CRT. Printed circuit boards for ease of assembly, constant circuit characteristics, and rugged component mounting. Includes all the design features necessary for servicemen, students, experimenters, radio amateurs, etc. Frequency response of amplifiers flat within 1 db from 10 cps to 100 kc, and down only 7 db from 10 cps to 500 kc. Sweep generator range from 20 cps to 100,000 cps. Also features new Heathkit color styling with charcoal gray panel and high definition white lettering for readability even under subdued lighting conditions.

DESIGN FEATURES: A full-size, versatile oscilloscope at a price you can afford. Other features are: adjustable spot shape control; RF connections to deflection plates; direct coupled centering controls; external and internal sweep and sync; 60 cycle line sync; built in 1 volt peak-to-peak panel terminal reference voltage; professional appearance of cabinet, panel, and knob styling.

58P1 CR TUBE



HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15,
MICHIGAN

Heathkit MULTIMETER KIT

The new Heathkit Multimeter is a "must" to complete the instrument lineup of any well equipped service shop. Here is an instrument packed with every desirable service feature, many of which are not found in other Multimeters. All of the measurement ranges you need or want. High sensitivity 20,000 ohms per volt DC; 5,000 ohms per volt AC.

★ ADVANTAGES

Complete portability through freedom from AC line power operation—provides service ranges of direct current measurements from 150 microamps up to 15 amperes—can be safely operated in RF fields without impairing accuracy of measurement.

★ RANGES

Full scale AC and DC voltage ranges are 0-1.5, 5, 50, 150, 500, 1500 and 5,000 volts. Direct current ranges are 150 microamps, 15, 150 and 500 milliamperes and 15 amperes. Resistances are measured from 2 ohms to 20 megohms in 3 ranges and dB range from -10 to +65 dB.

★ CONSTRUCTION

The Heathkit MM-1 features a unique resistor ring switch mounting assembly procedure. With this method of assembly the precision resistors are wired to the rings and range switch before actual mounting of the switch to the instrument panel. This procedure affords the advantage of simpler construction yet complete accessibility of precision resistors in event replacement is ever required. Ohmmeter batteries were selected for convenience of replacement and only standard commercially available types are used. Batteries consist of 1 type C flashlight cell and 4 Penlite cells. All batteries and necessary test leads are furnished with the kit.

20,000 ohms per volt sensitivity DC
5,000 ohms per volt AC

Polarity reversal switch eliminates transferring of test leads.

All 1% precision
100s—sensitive
microamp 4 1/2 50
Simpson meter

Total of 35 meter
ranges on two
color scale.

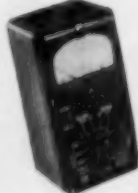
New modern cabinet
styling—attractive
appearance.

MODEL MM-1

\$26.50

Shpg. Wt. 6 lbs.

Heathkit HANDITESTER KIT



MODEL M-1

\$14.50

Shpg. Wt. 3 lbs.

The Heathkit Model M-1 Handitester readily fulfills major requirements for a compact, portable volt-ohm milliammeter. The small size of the smooth gleaming molded bakelite case permits the instrument to be tucked into your coat pocket, toolbox or glove compartment of your car. Always the "Handitester" for those simple repair jobs.

RANGES:

Despite its compact size, the Handitester is packed with every desirable feature required in an instrument of this type. AC or DC voltage ranges, full scale, 10, 30, 300, 1,000 and 5,000 volts. 2 convenient ohmmeter ranges 0-3,000 ohms and 0-300,000 ohms. 2 DC milliammeter ranges 0-10 milliamperes and 0-100 milliamperes.

CONSTRUCTION

The instrument uses a 400 microampere meter movement which is shunted with resistors to provide a uniform 1 milliampere load in both AC and DC ranges. This design allows the use of but 1 set of 1% precision divider resistors on both AC and DC and provides a simplicity of switching. A small hearing aid type ohms adjust control provides the necessary zero adjust function on the ohmmeter range. The AC rectifier circuit uses a high quality Bradley rectifier and a dual half wave backup. Necessary test leads and battery are included in the price of this popular kit.

Heathkit RESISTANCE SUBSTITUTION BOX KIT

MODEL RS-1

\$5.50



Shpg. Wt. 2 lbs.

Heathkit CONDENSER SUBSTITUTION BOX KIT

MODEL CS-1



\$5.50

Shpg. Wt. 2 lbs.

18 standard RTMA 1 watt resistor values between 15 ohms and 10 megohms with an accuracy of 10% are at your fingertips in the Model RS-1 Resistance Substitution Box kit. This sturdy and attractive accessory will easily prove its worth many times over as a time saving device. Order several today.

HEATH company

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BENTON HARBOR 15,
MICHIGAN

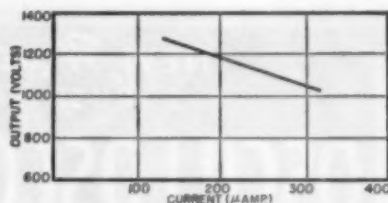


Fig. 2. Voltage output of series-resonant supply is affected by load current changes.

voltage is equal to 1200 volts d.c. When the load current is increased to 315 μ a., the output voltage falls to 1030 volts. These voltage and current changes result in a voltage regulation having a value of 17 per-cent. The voltage regulation is also affected by the value of the filter resistor used. The higher the value of filter resistor, the greater the load voltage change with changes in load current. If less ripple voltage is desired, the value of the output filter capacitor may be increased. **Caution:** Increasing the filter capacitance will increase the shock hazard.

Fig. 2 shows that one side of the a.c. line is coupled to "B minus" through one of the voltage doubling capacitors connected across the diode rectifiers. Therefore, avoid any applications that require grounding one side of the a.c. line directly to the chassis.

Applications

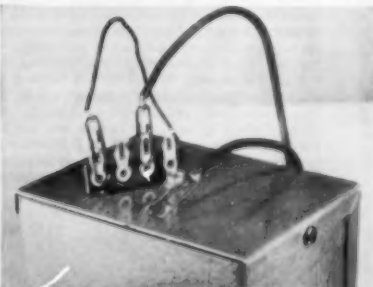
The series-resonant power supply is limited to applications that require small amounts of current drain. Some of its recommended uses include: supplying beam current to scope cathode-ray tubes, capacitor breakdown checker, and leakage measurements.

Constructing the series-resonant power supply should prove an interesting and helpful project since many interesting points concerning tuned circuits arise. The reactive voltage across L and C may rise to surprisingly large values depending on the "Q" of the coil, as mentioned previously. —30—

SIMPLE MINIATURE CLIPS

WHEN you need a number of small clips for that experimental circuit you're working on, try ordinary paper clips. They're easy to solder to, and can be used in place of alligator clips in most applications. Their small size makes them suitable in tight corners and for making connections to large transmitting coils. L. G.

Ordinary paper clips can be used in place of alligator clips where space is scarce.



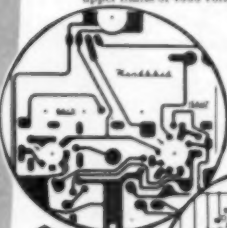
RADIO & TELEVISION NEWS

NEW Heathkit VACUUM TUBE VOLTMETER KIT PRINTED CIRCUIT DESIGN

Another outstanding example of continuing Heath Company pioneering and leadership in the kit instrument field. A new printed circuit VTVM. New peak-to-peak circuit—new styling and new panel design. A prewired, prefabricated printed circuit board eliminates chassis wiring, cuts assembly time in half, assures duplication of Engineering pilot model specifications, and virtually eliminates possibility of construction error.

CIRCUIT:

A 6AL5 tube operated as a full wave AC input rectifier permits seven peak-to-peak voltage ranges with upper limits of 4000 volts P-P. Just the ticket for you TV servicemen. Voltage divider in the 6AL5 input circuit limits applied AC input to a safe level. This circuitry and the isolation of the meter in the cathode of the 12AU7 bridge circuit affords a high degree of protection to the sensitive 200 microampere meter.



The first kit instrument to offer a labor-saving, error-free printed circuit board. Your instrument an exact wiring replica of Engineering development model.

Full wave rectifier in AC input circuit. Read peak-to-peak and RMS volts with upper limit of 4000 P-P and 1500 volts RMS. Voltage divider input circuit.

RANGES:

Seven voltage ranges, 1.5, 5, 15, 50, 150, 500 and 1,500 volts DC and AC RMS. Peak-to-peak ranges 4, 14, 40, 140, 400, 1400, 4000. Ohmmeter ranges X1, X10, X100, X1000, X10K, X100K, X1 meg. Additional features are a db scale, a center scale zero position, and a polarity reversal switch.

IMPORTANT FEATURES:

High impedance 11 megohm input—transformer operated—1% precision resistors. 6AL5 and 12AU7 tube—selenium power rectifier—individual AC and DC calibrations—smoother improved zero adjust control action—new panel styling and color—new placement of pilot light—new positive contact battery mounting—new knobs—test leads included.

The new V-7 also sets the pace as a kit instrument style leader. Smart, good-looking charcoal gray panel and soft feather gray cabinet. High readability panel with sharply contrasting white calibrations. The pleasing, eye catching, modern styling is in harmonious balance with the outstanding circuit design improvements. Easily the best buy in kit instruments.

New charcoal gray baked enamel panel with high readability white lettering. New soft feather gray cabinet, subdivided pilot light indicator.

New printed circuit board for faster, easier construction—exact duplication of Lab development model.



MODEL V-7

\$24.50

Shpg. Wt. 7 lbs.

New easy-to-read open panel layout. Off-on switch now incorporated in the selector switch.

New peak-to-peak meter scale—new color harmony—new knobs.

Heathkit AC VACUUM TUBE VOLTMETER KIT MODEL AV-2



\$29.50

Shpg. Wt. 5 lbs.

Extreme sensitivity has been emphasized in the design of the Heathkit AC VTVM. Ten full scale RMS ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts. Frequency response is substantially flat from 10 cycles per second to 50 KC with input impedance of 1 megohm at 1 KC. Will accurately measure as low as 1 millivolt at high impedance. Total db range is -52 db to +62 db. An excellent kit for measuring

the output of phono cartridges and the gain of amplifier stages. Use it also to check power supply ripple, as a sensitive null detector, and for compiling frequency response data. Features one knob operation, 200 microampere Simpson meter and precision resistors.

Heathkit AUDIO WATTMETER KIT

Read audio power output directly without using external load resistors with the new Heathkit Audio Wattmeter. Built-in non-inductive load resistors provide impedances of 4, 8, 16, and 600 ohms. Flat response from 10 CPS to 250 KC. Full scale power ranges are 0-5 MW, 0-50 MW, 0-500 MW, 0-5 W and 0-50 W. Model AW-1 will operate continuously at 25 watts and has a duty cycle of 3 minutes at 50 watts. Total db range in five positions is -50 db to +48 db, using the standard 1 milliwatt 600 ohms.



MODEL AW-1

\$29.50

Shpg. Wt. 6 lbs.

Heathkit 30,000 VOLTS DC PROBE KIT

Measure up to 30,000 volts DC with the Heathkit VTVM and the 336 high voltage Probe. Precision resistor provides multiplication factor of 100. Can be used with any 11 megohm input VTVM. Housed in a Polystyrene two color sleek plastic probe body for safety of operation.



No. 336

\$45.00

Shpg. Wt. 1 lb.

Heathkit PEAK-TO-PEAK PROBE KIT



No. 338-C

\$5.50

Shpg. Wt. 2 lbs.

Peak-to-peak values not exceeding 80 volts at a DC level of not more than 600 volts, can now be read directly by using 338-C Probe with previous model Heathkit VTVM's or any VTVM with 11 megohm input resistance. Probe construction features a modern printed circuit board for easy assembly. Frequency range 5 KC to 5 MC.

Heathkit RF PROBE KIT

The Heathkit RF Probe will permit the measurement of RF voltages up to 250 MC with an accuracy of $\pm 10\%$. The limits are 30 volts AC and a DC level of 500 volts. Designed for any 11 megohm input VTVM. Modern styling. Polystyrene aluminum housing. Polystyrene insulation, and printed circuit board for easy assembly.



No. 309-C

\$3.50

Shpg. Wt. 1 lb.

HEATH company

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MICHIGAN

Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

Here is the new 12 volt Heathkit Battery Eliminator so necessary for modern up-to-date operation of your Service Shop. Furnishes either 6 or 12 volt output which can be selected at the flick of a panel switch. Use the BE-4 to service all of the new 12 volt car radios in addition to the conventional 6 volt models.

RANGES:

This new Battery Eliminator provides two continuously variable output voltage ranges, 0-6 volts D.C. at 10 amperes continuously or 16 amperes maximum intermittent and 0-12 volts D.C. at 5 amperes continuously or 7.5 amperes maximum intermittent. The output voltage is clean and well filtered, as the circuit uses two 10,000 mfd condensers.

The continuously variable voltage output feature is of definite aid in determining the starting point of vibrators, the voltage operating range of oscillator circuits, etc.

OTHER USES:

The controllable low voltage DC supply has many other applications besides primary use in car radio service work. Can be nicely used as a battery charger, or low voltage DC supply for electric trains. Has applications in high gain audio work requiring clean DC filament supply. Can be used for low power electro-plating or as a power supply for battery powered intercommunication systems.

Automatic overload relay—self resetting—fuse protected.

New 18 plate split type, heavy duty rectifier unit.

Continuously variable output voltage, either 6 or 12 volt operation.

Constant ammeter and voltmeter monitoring.

MODEL BE-4

\$31.50

Shpg. Wt. 12 lbs.

Heathkit VIBRATOR TESTER KIT



MODEL VT-1

\$14.50

Shpg. Wt. 6 lbs.

This time-saving device will quickly pay for itself in your auto radio service shop. 6 volt vibrators can be checked instantly on the Good-Bad type meter scale. Operation requires only a variable DC voltage from 4 to 6 volts at 4 amperes. Model BE-4 Battery Eliminator is recommended for this application.

Five test sockets provide for the testing of hundreds of interrupter and self-rectifier types. Proper starting voltage is determined easily and accurately. Over-all quality is then unmistakably indicated on the panel mounted meter.

Heathkit VARIABLE VOLTAGE ISOLATION TRANSFORMER KIT

Variable output voltage between 90 and 130 volts AC. Rated at 100 volt—amperes continuously and 200 volt—amperes intermittently. The principle function of the Heathkit Isolation Transformer is to isolate the circuit being tested from line interference being caused by motors, appliances, etc. It works backward too by isolating such devices from the line.

Many other uses, especially with AC-DC type circuits. Do not confuse the Heathkit Isolation Transformer with the hazardous auto transformer type line voltage boosters.



MODEL IT-1

\$16.50

Shpg. Wt. 10 lbs.

Heathkit IMPEDANCE BRIDGE KIT



MODEL IB-2

\$59.50 Shpg. Wt. 12 lbs.

The new Heathkit Impedance Bridge features built-in adjustable phase shift oscillator and amplifier. This instrument actually represents four instruments in one compact unit. The Wheatstone bridge for resistance measurements, the Capacity Comparison bridge for capacity measurements, Maxwell bridge for low Q, and Hay bridge for high Q measurements.

DESIGN:

Panel provisions for external generator use. A new two section CRL dial, provides ten separate "units." Ten separate units switch settings and fractions of units are read on a continuously variable calibrated control. A special minimum capacity shielded and balanced impedance matching transformer between the generator and bridge circuit is automatically switched to provide correct load operation of the generator circuit. The instrument uses 1/2% precision resistors and condensers in all measurements circuits.

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MICHIGAN

Streamlined Servicing (Continued from page 41)

develop). It is wise, for this reason, to disconnect one end of the coupler and try another one even if the grid-to-ground voltage seems normal.

If rotation of the volume control causes noise, hum, or screeching to accompany the distortion, the control is most likely at fault; replacement is the best remedy in such a case.

A gassy power amplifier may cause distortion, particularly the type that occurs when the set has been in operation for some time.

Malalignment can cause a sideband-cutting type of distortion. Changing the station setting will vary the amount of distortion present in such a case, permitting its ready identification. Touch up the i.f. adjustments and note results. Return the slugs or trimmers to their original settings, if their re-adjustment doesn't improve reception.

A rubbing voice coil will cause distortion. Move the speaker cone gently back and forth in a straight line and listen for "rub." A broken spider on the speaker will introduce rattle and distortion; so will a partly uncemented one. Inspection will reveal such defects. Try adjusting the core of the PM speaker if the tone is thin.

If the output transformer has been recently replaced, and a hard-to-locate distortion is present, try a substitute test speaker-output transformer. The one present may (in rare instances) be an incorrect replacement.

Shrill reception may be due to an open in the plate bypass capacitor of the power amplifier. An open in the line bypass capacitor may also be responsible for shrill, noisy reception, particularly at the high end of the dial. Bridge either unit, to check.

Hum: If hum is noted only when a station is tuned in, try reversing the plug, and note results. If symptoms remain, check the external aerial by disconnecting it from the set—it may be shorted to ground at the roof, particularly in rainy weather.

Hum that persists with the volume control at minimum is either originating in the audio section or the power supply. Try new audio tubes or bridge the filters. Disconnect the old power supply capacitors when the bridging test does not eliminate the hum—sometimes an open in the common negative of a capacitor will cause hum to be present even when it is paralleled by a good unit. Then try the new capacitors once more.

A shorted or partially shorted choke may be the cause of a hum that cannot be eliminated by reducing the volume setting to zero—a resistance test will reveal this defect.

Improperly-dressed pilot light leads may introduce hum—be sure to dress them away from the first audio tube.

Drift: Check the dial-setting mechanism.

RADIO & TELEVISION NEWS

NEW *Heathkit* TV ALIGNMENT GENERATOR KIT

Here is the most radically improved Sweep Generator in the history of the TV service industry. The basic design follows latest high frequency techniques which result in a combination of performance features not found in any other sweep generator.

SWEEP:

Sweep action is obtained electronically through the use of a newly developed controllable inductor, thereby eliminating all moving parts with their resultant hum, vibration, fatigue, etc. Frequency coverage entirely on fundamentals, is continuous from 4 MC to 220 MC at an output level well over a measurable .1 volt.

Triple marker system, 4.5 MC crystal controlled marker—continuously variable marker—provisions for external marker.

MARKER:

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 19 to 60 MC on fundamentals, and 57 to 180 MC on calibrated harmonics. A separate fixed crystal controlled 4.5 MC marker can be used for checking IF, band-pass, calibration, reference, etc. Provisions are also made for external marker use. A 4.5 MC crystal is supplied with the kit.

POWER SUPPLY:

The transformer operated Power Supply features voltage regulation for stable oscillator operation. Three sets of shielded cables are furnished with the kit. Sweep range is completely and smoothly controllable from zero up to a maximum of 50 MC, depending upon base frequency.

Here is a TV Sweep Generator that truly no serviceman can afford to be without for rapid, accurate, TV alignment work.

Controllable inductor sweep oscillator with output entirely on fundamentals.

Triple marker system 4.5 MC crystal controlled—3 sets of cables included.

Electronically operated smooth continuous variable sweep circuit. No vibration, hum or noise.

Frequency coverage: 4 MC—220 MC continuous including FM spectrum. RF output well over .1 volt.

MODEL TS-3

\$44.50

Shpg. Wt. 18 lbs.



Automatic amplitude control circuit—constant output voltage regulated power supply.



NEW *Heathkit* SIGNAL GENERATOR KIT

MODEL SG-8

\$19.50

Shpg. Wt. 8 lbs.



The new Heathkit service type Signal Generator, Model SG-8 incorporates many design features not usually found in this instrument price range. Frequency coverage is from 100 KC to 110 MC in five ranges, all on fundamentals, with useful calibrated harmonics up to 220 MC. The RF output level is well in excess of 100,000 microvolts throughout the frequency range. The oscillator circuit consists of a twin triode tube, one-half used as a Colpitts oscillator, and the other half as a cathode follower output which acts as a buffer between the oscillator and external load, thereby eliminating oscillator frequency shift usually caused by external loading.

All coils are factory wound and adjusted, thereby completely eliminating the need for individual calibration and the use of additional calibrating equipment. The stable, low impedance output, features step and variable attenuation for complete control of RF level. A separate 6C4 triode acts as a 400 cycle sine wave oscillator, and a panel mounted switching system permits choice of either external or internal modulation.

NEW *Heathkit* BAR GENERATOR KIT



MODEL BG-1

\$14.50

Shpg. Wt. 4 lbs.

The Heathkit BG-1 produces a series of horizontal or vertical bars on a TV screen. Since these bars are equally spaced, they will quickly indicate picture linearity of the receiver under test without waiting for transmitted test patterns. Panel switch provides "standby—horizontal and vertical position." The oscillator unit uses a 12AT7 twin triode for the RF oscillator and video carrier frequencies. A neon relaxation oscillator provides low frequency for vertical linearity tests. The instrument will also provide an indication of horizontal and vertical sync circuit stability as well as overall picture size. Operation is simple and merely requires connection to the TV receiver antenna terminal. Transformer operated for safety.

Heathkit LABORATORY GENERATOR KIT

The new Heathkit Laboratory type Signal Generator definitely establishes a new performance standard for a kit instrument. An outstanding feature involves the use of a panel mounted 200 microampere meter calibrated both in microvolts and percent modulation, thereby providing a definite reference level for using the Signal Generator in design work, gain measurements, selectivity, frequency response checks.

DESIGN:

Additional design features are copper plated shield enclosure for oscillator and buffer stages resulting in effective double shielding. Fibre panel control shaft extensions in RF carrying circuits, thorough AC line filtering, careful shielding of the attenuator network, voltage regulated B plus supply, selenium rectifier, etc.

RANGES:

Frequency coverage from 150 KC to 30 MC all on fundamentals in five separate ranges. Output voltage .1 volt with provisions for metered external or internal modulation. Output impedance termination 50 ohms. Transformer operated power supply.

Investigate the many dollar stretching features offered by the LG-1 before investing in any generator for Laboratory or Service work.



MODEL LG-1

\$39.50

Shpg. Wt. 16 lbs.

HEATH company

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BENTON HARBOR 15,
MICHIGAN

Heathkit VISUAL-AURAL SIGNAL-TRACER KIT

The new Heathkit Visual-Aural Signal Tracer features a special high gain RF input channel used in conjunction with a newly designed wide frequency range demodulator probe. High RF sensitivity permits signal tracing from the receiver antenna input. Separate low gain channel and probe available for a radio circuit exploration. Both input channels are constantly monitored by an electron ray beam indicator so that visual as well as aural indications may be obtained.

NOISE LOCATOR:

A decidedly unusual feature is a noise locator circuit used in conjunction with the audio probe. With this system, a DC potential is applied to a suspected circuit component and the action of the voltage in the component can be seen as well as heard. Invaluable for ferreting out noisy or intermittent condensers, noisy resistors, controls, IF and power transformers, etc.

WATTMETER:

Built-in calibrated wattmeter circuit will prove useful for quick preliminary check of total wattage consumption of equipment under test. Separate panel terminals provide external use of the speaker or output transformer for substitution purposes. Saves valuable service time by eliminating the necessity for speaker removal on every service job. The same panel terminals also provide easy access to a well filtered B plus supply for external use. Don't overlook the many interesting service possibilities provided through the use of this instrument, and let the Signal Tracer work for you by saving time and money.

Substitution test speaker—utility amplifier.

Noise locator circuit—calibrated wattmeter.

RF and audio probes supplied along with necessary test leads.

Visual and aural signal tracing.

MODEL T-3

\$23.50

Shpg. Wt. 9 lbs.

Heathkit CONDENSER CHECKER KIT



MODEL C-3

\$19.50

Shpg. Wt. 7 lbs.

Here is a handy test instrument for any Service Shop. Unknown values of capacity and resistance are quickly determined on the direct reading condenser checker dial. Capacity is measured in four ranges from .001 mfd to 1000 mfd. Resistance in the range from 100 ohms to 5 megohms.

DC polarizing voltages of 25, 150, 250, 350, and 450 volts are available for leakage tests on all types of condensers. For electrolytics, a power factor control is provided to balance out inherent leakage and to indicate directly the power factor of a condenser under test. Proper balancing of the AC bridge is reflected in the degree of closure of an electron beam indicator tube.

Model C-3 uses a transformer operated power supply, spring return leakage test switch, and a convenient combination of panel scales for all readings. Test leads are furnished in addition to precision components for calibrating purposes. Quick and easy to operate, the Heathkit Condenser Checker will save valuable time and increase your Shop efficiency.

Heathkit "Q" METER KIT



MODEL QM-1

\$44.50

Shpg. Wt. 14 lbs.

The Heathkit QM-1 represents the first practical popular priced Q meter available within the price range of schools, laboratories, TV service men, and experimenters. This instrument will enable the operator to simulate conditions encountered in practical circuits and to measure the performance of coils or condensers at the operating frequencies actually encountered. All indications of value are read directly on the 4 1/2" 50 microampere Simpson calibrated meter scale. Measure Q of condensers, RF resistance, and the distributed capacity of coils. Oscillator section supplies RF frequencies 150 KC to 18 MC in four ranges. Calibrate capacity with range of 40 MMF to 450 MMF with vernier of ± 3 MMF. Investigate the many services this instrument can perform for you.

Heathkit AUDIO OSCILLATOR KIT

MODEL AO-1

\$24.50

Shpg. Wt. 10 lbs.

The Heathkit Audio Oscillator will produce both sine and square waves within the frequency range from 20 CPS to 20 KC in three ranges. Thermistor controlled linearity results in a variation of no more than ± 1 db in a 10 volt (no load) variable output level. There will be less than .5% distortion from 100 CPS throughout the audible range. Low impedance 600 ohm output. Precision 1% resistors, used in the range multiplier circuits to provide accurate calibration.

HEATH company

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MICHIGAN

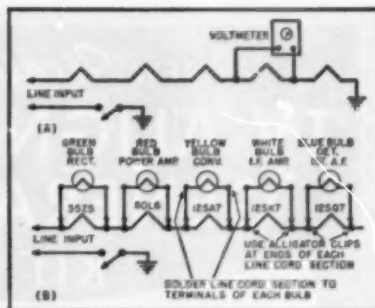


Fig. 3. Two methods of checking for an intermittently open heater. (A) Voltmeter test; (B) bridging each heater with a colored bulb—if a heater opens, the bulb in parallel with it will light up.

Next, try a new oscillator tube. When tube replacement doesn't remove the symptoms, replace the oscillator coil (if voltage and resistance measurements in the converter reveal no defect).

Whistles and squeals: These may be due to a loss of capacitance in the output filter capacitor, an open screen bypass in an r.f. or i.f. stage, an open plate bypass in the power amplifier, a missing shield or poor shield contact to ground, improper lead dress in i.f. stages, or misalignment.

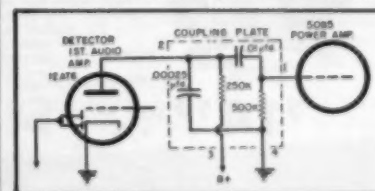
Intermittent reception: If tube heaters are seen to light intermittently, wiggle the line cord plug, checking whether it is defective. (Be sure also to check the power outlet.)

An intermittently open heater in a tube may be the cause of the trouble; to locate it, check heater voltage when the intermittent has disabled the set. The tube across which the full line voltage is read is the defective one. See Fig. 3.

In many recent-make a.c.-d.c. sets, printed circuits will be found in the audio stage. Fig. 4 shows a coupling plate used in various radios. When an open capacitor is to be checked for in circuits of this type, the capacitor may be bridged at either the terminals of the printed circuit unit to which it is brought out, or at the tube elements to which it connects. Manufacturer's data on the schematic will identify the terminals of the printed-circuit unit employed.

Tests are essentially the same as in the case of non-printed circuits, but replacement considerations are somewhat different. These are outside the scope of this article and have been described in other articles in this magazine.

Fig. 4. Shown here is the use of a printed circuit Couplate in the output circuit of the first audio amplifier of a radio.



RADIO & TELEVISION NEWS

Heathkit TUBE CHECKER KIT

The Heathkit TC-2 Tube Checker was primarily designed for the convenience of radio and TV servicemen and will check the operating quality of tubes commonly encountered in this type of work. Test set-up procedure is simplified, rapid, and flexible. Panel sockets accommodate 4, 5, 6, and 7 pin tubes, octal and loctal, 7 and 9 pin miniatures, 5 pin Hytron, and a blank socket for new tubes. Built-in neon short indicator, individual 3-position lever switch for each tube element, spring return test switch, 14 filament voltage ranges, and line-set control to compensate for supply voltage variations, all represent features of the TC-2.

Illuminated for easy reading and quick identification of chart reference.

Simplified construction—few harness type wiring—closer tolerance resistors.

Smart, professional appearance—available in counter or portable models.

Three color coded plastic-cased meter.

Improved smooth running roll chart mechanical action.



MODEL TC-2

\$29.50

Shpg. Wt.
12 lbs.

Heathkit PORTABLE TUBE CHECKER KIT

The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylin impregnated fabric covering with a contrasting gray on the inside of the detachable cover.

MODEL TC-2P

\$34.50

Shpg. Wt.
15 lbs.



Results of tube tests are read directly from the large 4 1/2" Simpson 3-color meter. Checks emission, shorted elements, open elements, and continuity. Wiring procedure has been simplified through the use of multi-wired color coded cable providing a harness type installation between tube sockets and lever switches. This procedure insures standard assembly and imparts a "factory built" appearance to the instrument. New Construction Manual furnishes detailed information regarding tube set-up procedure for testing of new or unlisted tube types. No delay necessary for release of factory data.

Heathkit REGULATED POWER SUPPLY KIT

MODEL PS-2

\$33.50

Shpg. Wt.
15 lbs.



Here is a source of regulated D.C. voltage for circuit development work. Power supply voltage and current drain to the circuit under test are constantly monitored by the 4 1/2" panel mounted meter. Separate 6.3 volt at 4 ampere A.C. filament source available. The regulated and variable output voltage will be constant over wide load variations, and hum ripple will not exceed .012% at 250 volts under a 50 MA load. Completely isolated circuit, standby switch, and other desirable features, make the Model PS-2 extremely useful in a wide variety of applications.

Heathkit TV PICTURE TUBE TEST ADAPTER

The Heathkit TV Picture Tube Test Adapter used with the Heathkit Tube Checker Kit, will quickly check picture tubes for emission, shorts, etc. and determine tube quality. Consists of standard 12-pin TV tube socket, four feet of cable, octal socket connector, and data sheet.



No. 355

\$4.50 Shpg. Wt.
1 lb.

Heathkit DECADE RESISTANCE KIT

MODEL DR-1

\$19.50

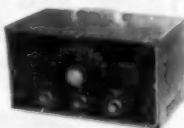
Shpg. Wt.
4 lbs.



Twenty 1% resistors are decade in 1 ohm steps to provide any value between 1 ohm and 99,999 ohms. Sturdy ceramic switches with silver plated contacts insure reliable service. Use the Decade Resistance in bridge circuits, meter multipliers, calibrations, or any application requiring a wide range of precision resistance values.

Heathkit AUDIO GENERATOR KIT

Here is an Audio Generator with features generally found only in the most expensive instruments. Sine wave coverage from 20 cycles to 1 Megacycle—response flat ± 1 db from 20 cycles to 400 Kc—continuously variable and step attenuated output. Because the output voltage is relatively constant over wide frequency ranges, the AG-8 is ideal for running frequency response curves in audio circuits. Once set by means of the attenuator, this voltage may be relied upon for accuracy within ± 1 db. Instrument features low impedance 600 ohm output circuit and distortion less than .4 of 1% from 100 CPS through audible range.



MODEL AG-8

\$29.50

Shpg. Wt. 11 lbs.

Heathkit DECADE CONDENSER KIT

The Heathkit Decade Condenser provides a ready source of capacity values from 100 mmf to .111 mfd inclusive in capacity steps of 100 mmf. Silver plated contacts on husky ceramic switches, assure positive contact for each switch position. Precision silver mica condensers $\pm 1\%$ accuracy for close tolerance accurate work.

MODEL DC-1

\$16.50

Shpg. Wt.
3 lbs.



HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15,
MICHIGAN.

NEW *Heathkit* HIGH FIDELITY PREAMPLIFIER KIT

Here is the exciting new Heathkit Preamplifier with all of the features you Audiophiles have asked for and at a down-to-earth price level. Beautiful satin gold baked enamel finish, striking control knobs and arrangement, attractive custom appearance and entirely functional design.

DESIGN:

Uses three twin triode tubes in a shock mounted chassis, 2-12AX7 and 1-12AU7. Features tube shielding, plastic sealed color coded capacitors, smooth acting controls, good filtering, excellent decoupling, low hum and noise level, and all aluminum cabinet. Special balancing control for absolute minimum hum level. Cathode follower, low impedance output circuit for complete installation flexibility.

SPECIFICATIONS:

Provides five switch selected inputs, 3 high level, and two low level, each with individual level controls—4 position LP, RIAA, AES, and early 78 equalization switch—4 position roll-off switch, 8, 12, 16 with one flat position. Separate tone controls, bass 18 db boost and 12 db cut at 50 CPS, treble 15 db boost, and 20 db cut at 15,000 CPS. Power re-

Equalization for LP, RIAA, AES, and early 78.

Separate bass and treble tone controls—special hum control.



Cathode follower low impedance output circuit.

Beautiful, modern appearance, blends with any interior or color scheme.

Five switch selected inputs with individual level controls.

Requirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12 1/2" wide x 5 1/4" deep x 3 3/4" high.

APPLICATION:

The new Heathkit WA-P2 Preamplifier has been designed to operate with any of the Heathkit Williamson Type Amplifiers and is directly interchangeable with the previous Model WA-P1 Preamplifier unit. Order your kit today and enjoy completely smooth control over the operation of your Hi-Fi system. Obtain the exact tonal balance of bass and treble with the precise degree of equalization you want. Note that the design of the WA-P2 accommodates the newly established RIAA curve.

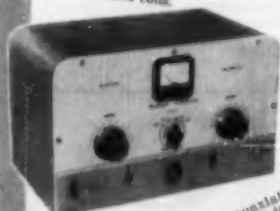
MODEL WA-P2

\$19.75

Shpg. Wt. 7 lbs.

HAM EQUIPMENT

Single knob band switching—prewound coils.



Crystal or VFO excitation—modulated operation.

MODEL AT-1

\$29.50

Shpg. Wt. 16 lbs.

filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliamperes power supply and 6U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

Heathkit AMATEUR TRANSMITTER KIT

The Heathkit AT-1 Transmitter has established a high reputation and has been enthusiastically accepted by hundreds of experienced operators as well as beginners. Power input up to 35 watts for the novice and suitable as a standby exciter for your higher powered rig later on.

Model AT-1 can be crystal or VFO excited and operates on 80, 40, 20, 15, 11 and 10 meters. The prewound coils with the oscillator and amplifier are switched simultaneously by the rugged band switch. Meter switch allows a reading of the final grid and plate current on the panel mounted meter. Modulator input and VFO power sockets are provided as well as a key jack for CW operation. Other features include a crystal socket, standby switch, key click filter, AC line filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliamperes power supply and 6U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

Brand
NEW

HEATHKIT VFO KIT

The new Heathkit VFO is the perfect companion to the Heathkit Model AT-1 Transmitter and it has sufficient output to drive any multi-stage transmitter of modern design. Good mechanical and electrical design insures operating stability. Coils are wound on stable, heavy duty, ceramic forms using Litz or double cellulose wire coated with Polystyrene cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspread. Kit is furnished with a carefully precalibrated scale which provides well over two feet of scale length. Smooth acting vernier reduction drive and illuminated dial provides easy tuning and zero beating.

Power requirements 6.3 volts AC at .45 ampere, and 250 volts DC at 15 ma. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter. Seven band coverage 160 through 10 meters with 10 volt average RF output. Uses 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

Copper plated chassis—aluminum cabinet—easy to build.

Smooth acting illuminated and precalibrated dial.



Seven band coverage 160 through 10 meters at 10 volt RF output.

6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

MODEL VF-1

\$19.50

Shpg. Wt. 7 lbs.

Heathkit GRID DIP METER KIT

The invaluable instrument for Hams, servicemen and experimenters. Useful in TV service work, for alignment of traps, filters, IF stages, peaking compensation networks, etc. Locates spurious oscillation, provides a relative indication of power in transmitter stages. Use it for neutralization, locating parasitics, correcting TVI, measuring CL and Q of components, and determining RF circuit resonant frequencies. The variable meter sensitivity control, headphone jack, 500 microampere Simpson meter, continuous frequency coverage from 2 MC to 250 MC. Prewound coil kit and rack included.

LOW FREQUENCY COILS:

Low frequency range extended to 355 KC by the use of two additional coils. Complete with dial correlation curves. Set 341-A for GD-1B and set 341 for GD-1A. Shpg. wt. 1 lb. Price **\$2.00**



MODEL GD-1B

\$19.50

Shpg. Wt. 4 lbs.



MODEL AC-1

\$14.50

Shpg. Wt. 4 lbs.

Heathkit ANTENNA COUPLER KIT

For the Heathkit AT-1 Transmitter or any comparable Amateur Transmitter. Will handle power up to 75 watts at its 52 ohm coaxial input. Matches a wide range of antenna impedances with its L type tuning network and neon indicator. A tapped inductance provides coarse adjustment and a transmitting type variable condenser sets it "right on the nose." Will operate on the 10 through 80 meter bands.

Heathkit ANTENNA IMPEDANCE METER KIT



MODEL AM-1

\$14.50

Shpg. Wt. 2 lbs.

Determine antenna resonance and resistance, transmission line surge impedance, and receiver input impedance. Works with one-half and one-quarter wave lines, half wave and folded dipole, harmonic mobile and beam antennas. Resistance type SWR bridge—100 microampere meter—frequency range 0-150 MC—impedance range 0-400 ohms.

HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15,
MICHIGAN

New LOW PRICED HEATHKIT SINGLE UNIT Williamson Type High Fidelity AMPLIFIER KIT

Here is the newest Heathkit Hi-Fi Amplifier at the lowest price ever quoted for a complete Williamson Type Amplifier circuit. The W-4 Model has been designed for single chassis construction, and only for the new Chicago Transformer Company Model BO-13 "super range" high fidelity output transformer. This transformer, a new development in the Hi-Fi field, is being offered at substantial saving over transformers of comparable quality. It is outstanding in performance and on the basis of our tests, we find it equal in every respect to transformers used in the W-2 and W-3 Heathkit series.

LOW PRICES:

Through utilization of a single chassis with resultant economy obtained through elimination of duplicate sheet metal fabrication, connecting cables, plugs, sockets, and a new Chicago "super range" output transformer, a 20% price reduction has been made possible without sacrificing kit quality.

COMPONENTS:

The new Heathkit W-4 uses the same heavy duty power transformer and choke. It has all of the features of previous models including individual jacks and a wire wound control to balance the output tubes—plastic high quality capacitors and the exact circuitry previously utilized in Williamson Type Amplifiers. Intermodulation distortion and harmonic distortion are both at the same low level as in the W-2 and W-3 models.

CONSTRUCTION:

Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble this Amplifier in a few pleasant hours.

Rugged, heavy duty,
single chassis
construction.

Output impedances
4, 8, and 16 ohms.

Standard
brand
components used,
no sacrifice of
quality.

Send for
free booklet
"High
Fidelity
Especially
For You."

Lowest price high quality
Williamson Type Amplifier
ever offered.

COMBINATIONS AVAILABLE

W-4M with Chicago "super-range" transformer only. Single chassis main amplifier and power supply. Shipping weight 28 lbs. Express only **\$39.75**

COMBINATION W-4 with Chicago "super-range" transformer only includes single chassis main amplifier and power supply with WA-F2 preamplifier kit. Shipping weight 35 lbs. Express only **\$59.50**

NEW Heathkit 20 WATT High Fidelity AMPLIFIER KIT



MODEL A-9B

\$35.50

Shpg. Wt. 24 lbs.

In keeping with the progressive policy of the Heath Company, further improvement has been made in the already famous Heathkit High Fidelity 20 Watt Amplifier. Additional reserve power has been obtained by using a heavier power transformer. A new output transformer designed and manufactured especially for the Heath Company, now provides output impedances of 4, 8, 16 and 500 ohms. The harmonic distortion level will not exceed 1% at the rated output.

FEATURES:

Outstanding features of the Heathkit 20 watt Amplifier include frequency response of ± 1 db from 20 CPS to 20 K.C. Separate (boost and cut) bass and treble tone controls. Four switch selected input jacks and a special hum balancing control. Flexibility is emphasized in the input circuits and proper equalization for all input devices is incorporated.

TUBE LINEUP:
12AX7 magnetic preamplifier and first audio amplifier. 12AU7 two stage amplifier with tone controls. 12AU7 voltage amplifier and phase splitter. Two 6L6 push-pull beam power output and 5U4G rectifier.
The Heathkit Model A-9B is excellent for custom installation and is designed for outstanding service at a very reasonable cost.

Heathkit SIX WATT AMPLIFIER KIT



MODEL A-7B

\$15.50

Shpg. Wt. 10 lbs.

An outstanding value, this economically priced 6 watt Amplifier is capable of performance expected only in much more expensive units. Only 2 or 3 watts output will ever be used in normal home applications and Model A-7B will be more than adequate for this purpose.

SPECIFICATIONS:

Two switch selected inputs are available for crystal and ceramic phono pickups, tuner, TV audio, tape recorder, and carbon type microphone. Model A-7B features separate bass and treble tone controls, push-pull balanced output stages, output impedances of 4, 8, and 15 ohms, and extremely wide frequency range $\pm 1\frac{1}{2}$ db from 20 CPS to 20 K.C. Not just a souped up AC-DC job. Full wave rectification, transformer operated power supply and good filtering, result in exceptionally low hum level.

MODEL A-7C

Provides a preamplifier stage and proper compensation for the variable reluctance cartridge and low level microphone. \$17.50

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

Here is the famous kit form Williamson Type High Fidelity Amplifier that has deservedly earned highest praise from every strata of Hi-Fi music lovers. Virtually distortionless, clean musical reproduction, full range frequency response, and more than adequate power reserve.

OUTPUT TRANSFORMERS:

This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous Acrosound TQ-300 output transformer. This quality transformer features the popular "ultra-linear" output circuit for clean maximum power level. Separate chassis for amplifier and power supply.

SPECIFICATIONS:

Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt output less than .5% between 20 cycles and 20,000 cycles. IM distortion at 5 watts equivalent output .5% using 60 and 3,000 cycles. Output impedances of 4, 8, or 16 ohms. Overall dimensions for each unit 7" high x 5 $\frac{1}{2}$ " wide x 11 $\frac{1}{2}$ " long.

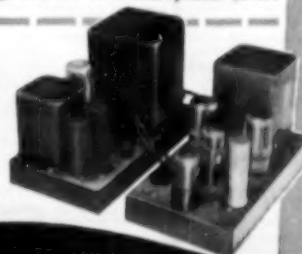
CONSTRUCTION MANUAL:

This fine kit is supplied with a completely detailed step-by-step Construction Manual and the only effort required is the assembly and wiring of the pre-engineered kit. Even the complete novice can successfully construct this Amplifier and have fun building it.

COMBINATIONS AVAILABLE:

W-3 Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer, Power Supply and WA-F2 Preamplifier.) Shipping weight 37 lbs. Shipped express only. **\$69.50**

W-3M Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **\$49.75**

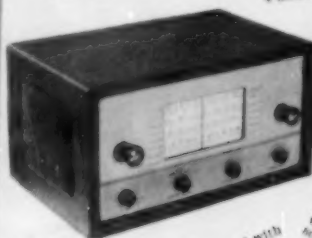


HEATH company

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15,
MICHIGAN

Continuous coverage
550 KC—35 MC on
A Bands.



Phone—standby
—C/W panel
switch.

RF gain control with
AOC on-off switch

MODEL AR-2

\$25⁵⁰

(Less Cabinet)

Electrical band-
spread tuning
with logging
sales.

Heathkit COMMUNICATIONS RECEIVER KIT

An excellent example of typical Heath Company ability to produce top quality kit merchandise at ridiculously low prices, is the AR-2 Communications Receiver. Here is a transformer operated all-wave receiver with all of the desired features and none of the disadvantages commonly encountered in so-called "economy sets."

an inductor assembly has a 100-ohm miniature (tube) IF transformer, chassis mounted 51/2" PM speaker, headphones, a slide rule dial with Ham Bands plainly identified, and easy tuning with direct planetary drive. Continuous frequency coverage from 550 KC to 35 MC on 4 bands, with electrical bandspread tuning and logging scales. Other features are RF gain control with AGC on-off switch—phone—standby—CW—panel switch—prewound coils in a shielded turret assembly and copper plated chassis and shielding.

power output, 12BA6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector-first audio, 12AQ6 beam power output, 12BA6 BFO oscillator, 12AV6 second audio, 5Y3 rectifier. A lettered control plate is provided for the cabinet of your choice or you can order the optional Heathkit cabinet featuring the full size aluminum panel.

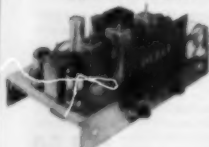
RECEIVER CABINETS

Proxyn impregnated fabric covered plywood cabinet available for BR-2 and AR-2 receivers. Includes aluminum panel, flocked reinforced speaker grill and protective rubber feet.

For BR-2 Receiver, Cabinet 91-9
Shipping weight 5 lbs. **\$4.50**

AR-2 Receiver, Cabinet 91-10	
Shipping weight 5 lbs.	\$4.50

Heathkit FM TUNER KIT



MODEL FM-2

\$22⁵⁰

Shpg. Wt. 8 lbs.

Here is an FM Tuner that can be operated with your Hi-Fi Amplifier or through the "phone" section of the ordinary radio. Completely AC operated to eliminate problems usually encountered in " Economy type" AC-DC tuner circuits. Features 5 tube circuit with electronic mixer and oscillator, 3 double tuned IF stages followed by a limiter discriminator providing maximum sensitivity and selectivity across the full FM frequency band of 88 MC to 108 MC. The tuning unit is factory assembled and adjusted, thus eliminating tedious critical "front end" alignment problems. The attractive slide rule dial and vernier tuning combine to make the Heathkit FM-3 Tuner simple to operate.

Heathkit

BROADCAST BAND RECEIVER KIT

The Model BR-2 Broadcast Band Receiver is designed especially for the beginner without any sacrifice of quality. This receiver features a transformer-coupled tuned circuit, a very high gain, miniature tube, sharply tuned IF transformer, a new rod type built-in antenna, and a trouble-free planetary tuning system. Exceptional performance with unusually high sensitivity, good selectivity, and excellent tone quality from the 51 1/2" PM chassis mounted speaker. Can be used either as a receiver, tuner, or phono amplifier. Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector, 12AG beam power output, and 5Y3 rectifier.



MODEL BR-2

\$17⁵⁰

(Less Cabinet)

Shpg. Wt. 10 lbs.

HEATH COMPANY • Benton Harbor 15, Mich.

ORDER BLANK



WALNUT 5-1175

MAIL YOUR ORDER
TODAY TO THE
HEATH COMPANY
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15,
MICHIGAN

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SHIP VIA

☐ Parcel Post
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☐ Freight
☐ Best Way

(PLEASE PRINT)

[illegible]

Enclosed find () check () money order for _____
Please ship C.O.D. () postage enclosed for _____ pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS insure postage for weight shown.

ORDERS FROM CANADA and APO's must include full remittance.

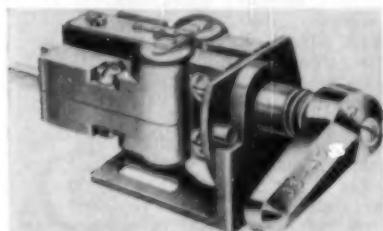
NEW AUDIO EQUIPMENT

MAGNETIC CARTRIDGE

Recoton Corporation, 147 West 22nd Street, New York 11, New York has introduced a new magnetic cartridge which is moderately priced.

The Model 500 is of the turnover type, using separate stylus for 78's and 33's. It may be installed in any standard tone arm equipped with $\frac{1}{2}$ " center mounting holes. The cartridge features a push-pull coil assembly which cancels out hum originating in turntable motors and nearby electrical appliances. Additional protection against hum pickup is afforded by a Mu-metal shield around the pole-piece assembly.

Frequency response of the cartridge is virtually flat from 20 to 16,000 cps.



High compliance and low moving mass permit excellent tracking at 6 to 7 grams, with distortion reduced to a practical minimum.

A descriptive sheet is available from the company.

PREAMP-EQUALIZER CONTROL

A preamplifier-equalizer control unit for sound reproduction systems has been added to the Webster Electric Company line of audio equipment.

Designated as the Model 97-0, this unit can be used to control the tone and volume of a radio, tape recorder, television set, or phonograph, and to provide equalization for all types of phono records.

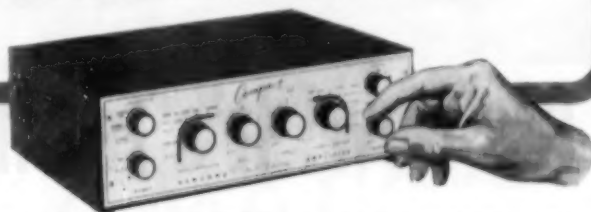
The unit has two equalizer selectors; one for high-frequency roll-off and one for low-frequency turnover



which provide a total of 25 combinations of settings. It has a six-position input selector for a tuner, television set, tape recorder, microphone, and magnetic and ceramic cartridges.

From NEWCOMB'S Big, NEW HI-FI LINE

The two new Compacts, with amplifier, preamplifier and control unit all in one...the new Classic 200 FM-AM Tuner, the answer to years of demand...just three of the twelve all new components in the Newcomb line—a line which offers an amplifier for every hi-fi need. All twelve reflect the engineering leadership for which Newcomb has been famous since 1937. Visit your dealer...see and hear the full Newcomb line and you'll understand why Newcomb is your best buy in hi-fi!



HI-FI COMPLICATED? EXPENSIVE? NOT WITH NEWCOMB'S COMPACT 12!

Newcomb offers every music lover authentic high fidelity with a minimum of expense and trouble in the new Compact 12. Provides unequalled flexibility and range of sound control. Needs no cabinet. Just plug it in, connect it to a record changer and speaker. But if you prefer to use cabinetry, it includes Newcomb's exclusive "Adjusta-Panel" feature for easy installation. Simple to move—ideal for apartments! U/L approved.

Compact 10—A simplified 10-watt version of exceptional performance.



Compact 12 Specifications

12-watt high fidelity amplifier—preamplifier—control unit • less than 1% distortion at 12 watts • response ± 1 db 20 to 20,000 cycles • separate crossover and rolloff controls give 36 different recording curves • input selector and rumble filter • 7 inputs • mike input • tape input • output to tape • wide range separate bass and treble tone controls, bass range —15 db to +18 db, treble range —18 db to +16 db • hum balance control • new level control • advanced design loudness control • size only $4\frac{1}{2}$ " high x $12\frac{1}{2}$ " x 9".

FOR SUPERIOR RADIO RECEPTION NEW Classic 200—2 knob FM-AM Tuner

For years now, satisfied Newcomb amplifier owners have asked for a tuner by Newcomb. Here it is—the Classic 200 high fidelity tuner to deliver the utmost to a fine amplifier! It, too, is compact in size.

Designed for use with any amplifier having its own controls. Fully enclosed, beautifully finished to use as is, or the exclusive "Adjusta-Panel" makes cabinet installation simple. U/L approved. Output is 10 volts at less than $\frac{1}{10}$ %, 1 volt at less than $4/100\%$. Effective to 200 feet from amplifier. Many new circuit advances in both FM and AM sections. Results: 30 db of quieting with only $1\frac{1}{2}$ microvolts input on FM. 1 microvolt AM sensitivity for 1 volt output. Only $6\frac{1}{2}$ " high x $11\frac{1}{2}$ " x $11\frac{1}{2}$ ".



HI-FI GUIDEBOOK

"Hi-Fi Is For Everybody" Explains the how and why of authentic high fidelity • How to buy and install economically • Informative and thoroughly illustrated • Not a catalog



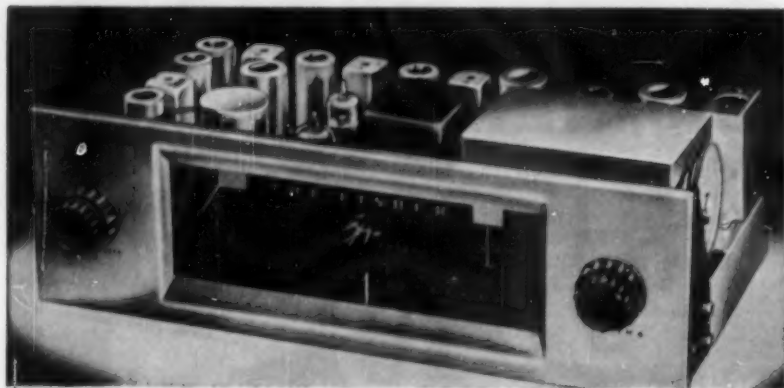
NEWCOMB® SINCE 1937

High Fidelity Amplifiers and Tuners

- ☐ Here's 25c for new book, "Hi-Fi Is For Everybody."
- ☐ Please send free catalog of Newcomb's complete line of 12 new hi-fi products, plus name of my nearest Newcomb dealer.

NEWCOMB, Dept. F-3
6824 Lexington Ave., Hollywood 38, California

Name _____
Address _____
City _____ Zone _____ State _____



It's New! It's Terrific!

THE 
FISHER

FM TUNER MODEL FM-80

World's Best by LAB Standards

FOR almost two decades we have been producing audio equipment of outstanding quality for the connoisseur and professional user. In the cavalcade of FISHER products, some have proved to be years ahead of the industry. THE FISHER FM-80 is just such a product. Equipped with TWO meters, it will outperform any existing FM Tuner *regardless of price!* The FM-80 combines extreme sensitivity, flexibility and micro-accurate tuning. Despite its full complement of tubes and components, the FM-80 features an unusually compact chassis of fine design. **Only \$139.50**

Outstanding Features of THE FISHER FM-80

- TWO meters; one to indicate sensitivity, one to indicate center-of-channel for micro-accurate tuning. • Armstrong system, with two IF stages, dual limiters and a cascode RF stage. • Full limiting even on signals as weak as one microvolt. • Dual antenna inputs: 72 ohms and 300 ohms balanced (*exclusive!*) • Sensitivity: $1\frac{1}{2}$ microvolts for 20 db of quieting on 72-ohm input; 3 microvolts for 20 db of quieting on 300-ohm input. • Chassis completely shielded and shock-mounted, including tuning condenser, to eliminate microphonics, and noise from otherwise accumulated dust. • Three controls — Variable AFC/Line-Switch, Sensitivity, and Station Selector PLUS an exclusive Output Level Control. • Two bridged outputs. Low-impedance, cathode-follower type, permitting output leads up to 200 feet. • 11 tubes. • Dipole antenna supplied. Beautiful, brushed-brass front panel. • Self-powered. • WEIGHT: 13 pounds. • SIZE: $12\frac{3}{4}$ " wide, 4" high, $8\frac{1}{4}$ " deep including control knobs.

Price Slightly Higher West of the Rockies

WRITE TODAY FOR COMPLETE SPECIFICATIONS

FISHER RADIO CORP. • 21-25 44th DRIVE • L. I. CITY 1, N. Y.

The Model 97-0 has a frequency response of 20 to 20,000 cps, ± 1 db. It is 15" wide, 4" high, and 9" deep.

Further information is available from the Sound Sales Division of the firm at 1900 Clark Street, Racine, Wisconsin.

NEW 4-INCH PM SPEAKER

Quam-Nichols Company, Marquette Road and Prairie Avenue, Chicago 37, Ill. has developed a new speaker of extremely shallow construction which is designed to solve the technician's problem where space and cost are of primary importance.

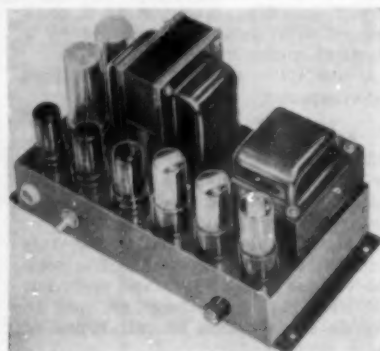
The "Little Four" (Model 4A06) is a rugged 4" PM type with a miniature magnet construction which permits its installation in any radio or TV set. It has RETMA standard rim mounting holes and .58 oz. Alnico V magnet with U-shaped pot. Maximum watts input is 2.5. Voice coil impedance is 3.2 ohms $\pm 10\%$.

A data sheet on this speaker is available upon request.

10-WATT AMPLIFIER

Webster Electric Company, 1900 Clark Street, Racine, Wisconsin has announced the addition of a 10-watt audio amplifier to its line.

Known as the Model 96-10, this amplifier has a frequency response at 1 watt output of 20 to 40,000 cps, flat within .3 db. At 10 watts output, response is flat ± 0.5 db 20 to 22,000 cps. Harmonic distortion is .3 per-cent at 3 watts, 50 cycles and .75 per-cent at 10 watts, 50 cycles. Noise level is -80



db below 10 watts. Output impedances of 4, 8, and 16 ohms are available.

The amplifier is 12" wide, 6 1/2" deep, and 6 1/2" high. It weighs 16 pounds and is finished in antique copper. Further information is available from the Sound Sales Division of the company in the form of Bulletin R8A1.

STEREOPHONIC RECORDER

The Pentron Corporation, 777 South Tripp Ave., Chicago 24, Illinois has designed and built a new stereophonic "Dynacord" magnetic tape recorder which is the heart of the firm's "All-Electronic Orchestra."

This new "All-Electronic Orchestra" consists of a specially designed "Dynacord" recorder and reproducer, incorporating six separate high-fidelity loudspeaker systems. In playback, each

RADIO & TELEVISION NEWS

recorded channel is fed through a separate loudspeaker system resulting in true stereophonic sound with the additional advantage of spatial perspective.

The unit has a professional tape transport mechanism plus six preamplifiers with vu meters, all mounted in the upper part of a console. Each vu meter gives recording level control for monitoring each of the six individual channels. The lower part of the console houses the mixer, power supply, and six power amplifiers. The purpose of the mixer is to electronically mix six channels for monitoring during recording, at the same time maintaining isolation of the different tracks.

DUAL-CONCENTRIC SPEAKERS

Plessey International Ltd., Ilford, Essex, England has developed two new dual-concentric loudspeakers, one a 12" and the other a 15".

Each unit has a 6" x 4" elliptical loudspeaker, with a speech coil of aluminum wire, mounted concentrically with the low-frequency cone, giving a good high-frequency response with wide polar distribution. A crossover network, operating at a frequency of 2000 cps, is mounted on the arms of the bass loudspeaker. This network employs an air-cored inductor and a paper dielectric capacitor to ensure reliability and freedom from distortion.

In the 12" model, the speech coil is 1" in diameter and works in a field of either 10,000 or 12,000 gauss, according to the requirements of the customer, while the high-frequency speaker has a flux density of 8500 gauss. Frequency coverage is 40 to 15,000 cps.

The 15" model has a 2" diameter speech coil and works in a field of 15,000 gauss with a total of 228,000 lines, while the high-frequency speaker has a flux density of 12,000 gauss. Response extends from 20 to 17,000 cps.

SPEAKER-MICROPHONE

Telex, Inc., Telex Park, St. Paul 1, Minnesota has combined a new dynamic speaker-microphone into a small, compact, low cost unit.

Designated Model #100, the unit is housed in a steel and thermoplastic case which can be mounted in the mike



housing of dictating machines, portable radio transceivers, and other electronic apparatus where a transmitting-receiving unit is desired. An externally-mounted transformer for matching the microphone to the grid circuit is available.

March, 1955

SWEEPING THE COUNTRY

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IN AMPLIFIER DESIGN
IN TWENTY YEARS!

FISHER Z-MATIC

PAT. PEND.

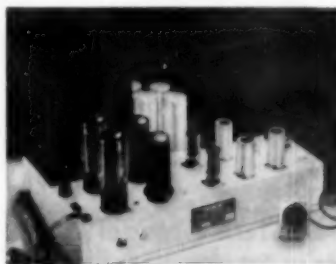
At the recent Audio Fairs in New York, Chicago, Boston and Los Angeles, by far the greatest crowds were to be found listening to demonstrations of FISHER Z-Matic, one of the outstanding technological advances in amplifier design in twenty years. Regardless of the speaker system, be it a modest 8" unit or a giant assembly, the vast acoustic improvement contributed by FISHER Z-Matic is instantly apparent, and truly astonishing. For Z-Matic has at one stroke eliminated the energy-wasting, distortion-producing mismatch that has prevented the complete union of speaker and amplifier ever since the advent of electronic sound reproduction. Z-Matic is now built into all FISHER amplifiers, at no increase in cost.

What Z-Matic Does

- Multiplies the efficiency and effective audible range of any speaker system, regardless of size.
- The continuously variable Z-Matic control permits any setting, according to personal taste or the requirements of the speaker system.
- Eliminates need for oversize speaker enclosures and automatically corrects inherent deficiencies in speaker or speaker housing.
- Z-Matic must not be confused with tone, equalization, loudness balance or damping factor controls. It is an entirely new development.
- Only FISHER amplifiers have Z-Matic.

A Word to Our Patrons

Your FISHER 50-A or 70-A amplifier can be readily equipped with Z-Matic. A complete kit of parts and easy-to-follow instructions are available at a cost of only \$2.50 to cover handling. Give serial number and model.



50-Watt Amplifier • Model 50-AZ

100 watts peak! World's finest all-triode amplifier. Uniform within 1 db, 5 to 100,000 cycles. Less than 1% distortion at 50 watts. Hum and noise 96 db below full output. Oversize, quality components and finest workmanship. \$159.50



Master Audio Control • Series 50-C

"Finest unit yet offered." — Radio and TV News. 25 choices of record equalization, separate bass and treble tone controls, loudness balance control, 5 inputs and 5 independent input level controls, two cathode follower outputs. Chassis, \$89.50 • With cabinet, \$97.50



25-Watt Amplifier • Model 70-AZ

50-watts peak! More clean watts per dollar. Less than 1/2% distortion at 25 watts (0.05% at 10 watts.) Response within 0.1 db, 20-20,000 cycles; 1 db, 10 to 50,000 cycles. Hum and noise virtually non-measurable! \$99.50

Prices Slightly Higher West of the Rockies

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FOR THE FULLEST ENJOYMENT
OF YOUR HOME MUSIC SYSTEM

FISHER ACCESSORIES



MIXER-FADER • Model 50-M

NEW! Electronic mixing or fading of any two signal sources (such as microphone, phono, radio, etc.) No insertion loss. Extremely low hum and noise level. High impedance input; cathode follower output. 12AX7 tube. Self-powered. Beautiful plastic cabinet. **Only \$19.95**



PREAMPLIFIER-EQUALIZER • 50-PR

Professional phono equalization. Separate switches for HF roll-off and LF turn-over; 16 combinations. Handles any magnetic cartridge. Extremely low hum. Uniform response, 20 to 20,000 cycles. Two triode stages. Fully shielded. Beautiful cabinet. Self-powered. **\$22.95**



PREAMPLIFIER-EQUALIZER • 50-PR-C WITH VOLUME CONTROL

50-PR-C. This unit is identical to the 50-PR but is equipped with a volume control to eliminate the need for a separate audio control chassis. It can be connected directly to a basic power amplifier and is perfect for a high quality phonograph at the lowest possible cost. **\$23.95**



HI-LO FILTER SYSTEM • Model 50-F

Electronic, *sharp* cut-off filter system for suppression of turntable rumble, record scratch and high frequency distortion — with *absolute minimum* loss of tonal range. Independent switches for high and low frequency cut-off. Use with any tuner, amplifier, etc. **\$29.95**



PREAMPLIFIER • Model PR-5

A self-powered unit of excellent quality, yet moderate cost. Can be used with any low-level magnetic cartridge, or as a microphone preamplifier. Two triode stages. High gain. Exclusive feedback circuit permits long output leads. Fully shielded. Uniform response, 20 to 20,000 cycles. The best unit of its type available. **\$12.57**

OUR APOLOGIES...

■ If you were one of the thousands who had to wait for delivery on your FISHER audio equipment during December and January, may we extend our apologies for any inconvenience caused you. The demand for FISHER equipment simply outran the available supply. We want to thank you for your patience and loyalty and know they will be rewarded in the knowledge that the best was worth waiting for!

WRITE TODAY FOR COMPLETE SPECIFICATIONS

FISHER RADIO CORP. • 21-23 44th DRIVE • L. I. CITY 1, N. Y.

Sensitivity of the microphone with transformer is 52 db below 1 volt per dyne per square centimeter of sound pressure. As a receiver, the unit will deliver 120 decibels of sound pressure with 10 milliwatts of power input. Nominal impedance is 10 ohms.

Dimensions of the speaker-microphone are 1" x 1" x 3/4" and weight is approximately 1 1/2 ounces. For additional information on this unit, write Dept. KP of the company, mentioning this publication.

MINIATURE SPEAKER

Jensen Manufacturing Co., 6601 S. Laramie, Chicago, Illinois is in production on a compact, miniature, high-



ly-sensitive loudspeaker which has been especially designed for transistorized pocket radios.

The P275-Y measures 2 1/4" in diameter, 1 1/2" in depth, and weighs less than 2 1/4" ounces. Normal voice coil impedance at 1000 cycles is 16 ohms.

GARRARD INNOVATIONS

Garrard Sales Corporation, 164 Duane Street, New York 13, N. Y. has added several new features to its record playing equipment to facilitate and simplify installation.

All of the units are now supplied with six feet of UL-approved line cord and with a pickup cable, terminating in a standard phono jack.

Another feature is the completely new type of mounting suspension, easily installed by simply pressing the mounting hardware, once it is attached to the changer, into the holes of the baseboard. This automatically locks the unit in place. Inasmuch as there are no nuts or adjustments to be made on the motorboard proper, "floating" installation of the changer is greatly expedited.

A further feature is that the level of each spring can be adjusted from the top of the record changer.

RECORD CLOTH

Mill River Automotive Products Corp., 722 Middle Neck Road, Great Neck, N. Y. has developed a new cleaning cloth which is being marketed as the "Swami No-Static."

The cloth is a specially woven, super-soft, downy-napped lintless flannel cloth which has been impregnated with an exclusive composition of anti-static agents. When records or styli are cleaned with this cloth, the accumu-

lated dust is removed and at the same time a molecular film of highly potent anti-static agents is deposited on the record. This film dissipates the static charges which attract dust and remains highly effective for a considerable period of time.

The new cloth is currently available at dealers or from the manufacturer direct.

REAR SEAT SPEAKER

General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Illinois has recently introduced a "Rear Seat Speaker Baffle Kit" for service technicians.

The new kit includes a metal grille and three-position switch. The grille is said to be both fadeproof and tamperproof to protect the speaker cone from damage. The switch, to be mounted on the dashboard, permits a choice of either speaker or both simultaneously. Colors available are either gray or brown.

The kit is designed to be used with any quality speaker on the market. It will be available through distributors from coast to coast.

LADDER NETWORK

The Daven Company, Dept. RF, 191 Central Avenue, Newark 4, N. J. has announced the availability of a continuously variable unbalanced ladder network, the Series LA-920.

The new unit allows continuous variation of attenuation and is recommended for applications where sound levels must be changed smoothly without any transient disturbances, or where levels must be set closer than in step-type units.

The standard series is available in terminal impedances of 30/30, 50/50,



125/125, 150/150, 200/200, 250/250, 500/500, 600/600. Special designs are available on a custom basis.

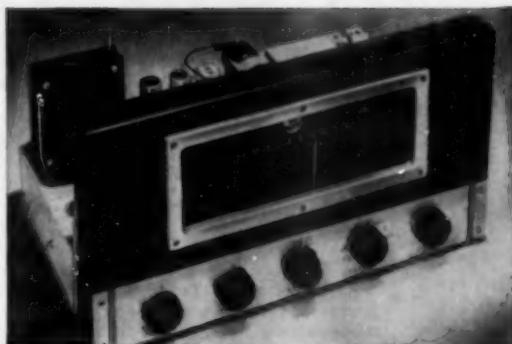
12" SPEAKER GRILLE

D & M Products, 13144 W. McNichols Rd., Detroit 35, has announced the addition of a 12" speaker grille to its line.

The new grille has been specifically designed to meet the demand for the custom installation of 12" speakers in new or existing construction. It is available in chrome or neutral grey hammertone. A prime coat finish is also available where painted finish is required by the installation. The unit comes complete with grille cloth and required hardware.

-50-

March, 1955



MODEL 70-RT

World's
Finest

BY LAB
STANDARDS

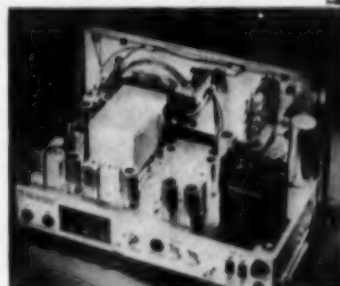
FISHER

Professional FM-AM TUNERS

THE truest index to the quality of FISHER Tuners is the roster of its exacting users. Among our professional patrons are Eastern FM stations who specifically chose THE FISHER, after competitive trials, on remote pickups for rebroadcast to their own communities. Reception of FM stations over 150 miles distant, terrain permitting, is a regular occurrence if you own a FISHER.

MODEL 70-RT

■ Features extreme sensitivity (1.5 mv for 20 db of quieting); works where others fail. Armstrong system, adjustable AFC on switch, adjustable AM selectivity, separate FM and AM front ends. Complete shielding and shock-mounting on main and subchassis. Distortion below 0.04% for 1 volt output. Hum level: better than 90 db below 2 volts output on radio, better than 62 db below output with 10 mv input on phono. Two inputs. Two cathode follower outputs. Self-powered. Exceptional phono preamplifier with enough gain for even lowest-level magnetic pickup. Full, phono equalization facilities. 15 tubes. Six controls, including Bass, Treble, Volume, Channel/Phono-Equalization, Tuning and Loudness Balance. Beautiful Control Panel. SIZE: 14 1/4" wide, 8 1/4" high, 9 1/4" deep.



MASTERPIECE OF TUNER DESIGN

MODEL 50-R

■ Identical to the 70-RT but designed for use with an external preamplifier-equalizer, such as the FISHER Series 50-C.

MODEL 50-R



MODEL 70-RT

\$184.50

MODEL 50-R

\$164.50

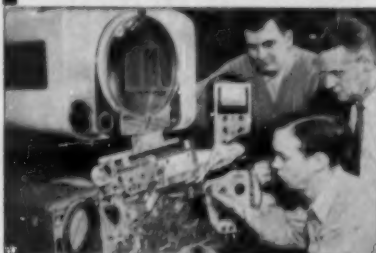
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You can save a year by optional year 'round study. Previous military, academic, or practical training may be evaluated for advanced credit.

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You can be a radio technician in 12 months. In an additional 6-months you can become a radio-television technician with Associate in Applied Science degree. Color television instruction is included in this program.

These technician courses may form the first third of the program leading to a degree in Electrical Engineering. Twenty-one subjects in electronics, electronic engineering and electronic design are included in these courses.

Courses also offered: radio-television service (12 mos.); electrical service (6 mos.); general preparatory (3 mos.).

Terms—April, July, September, January

Faculty of specialists. 50,000 former students—annual enrollment from 40 states, 23 foreign countries. Non-profit institution. 52nd year. Courses approved for veterans. Residence courses only.



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Address.....

City.....State.....

If veteran, indicate date of discharge.....

Within the Industry (Continued from page 33)

at 25 Valley Road in Montclair, New Jersey . . . An electronics products division which will specialize in subcontract work on military and industrial electronic projects has been established by **ARVIN INDUSTRIES, INC.** Leo W. Burns is the sales manager of the new division . . . A new wholesale distributing firm featuring parts and accessories for radio, television, and other devices has opened at 20 Willoughby Street in Brooklyn as **DIAL ELECTRONICS** . . . Paul M. Cornell has formed his own sales organization, **CORNELL SALES COMPANY**, with headquarters at 1340 Ford Road, Lyndhurst, Ohio.

STEREO-SOUND SOCIETY has been organized at 6356 De Longpre Avenue, Hollywood 28, California for the purpose of providing latest information on new developments in stereophonic recordings and equipment to the public.

Created as a non-profit organization, the new society is being sponsored by engineers, manufacturers, and representatives of the audio industry. The idea was conceived by John de Yaiser. C. M. Brainard is chairman of the group.

The Society will have information on stereophonic sound available for free distribution. The mailing list is now being compiled.

CHARLES EISLER, JR. has been elected president of *Eisler Engineering Co., Inc.* of Newark, N.J. succeeding his father, Dr. Charles Eisler, founder of the firm, who moved up to chairman of the board.

Mr. Eisler was formerly vice-president of the company which manufactures indexing turntables, positioners, and other machinery used in the radio tube industry and other fields.

He holds mechanical, electrical, and metallurgical engineering degrees from M.I.T. and Stevens Institute of Technology.

DR. DONALD B. SINCLAIR has been appointed vice-president of engineering for *General Radio Company* of Cambridge, Mass. He has been with the firm since 1936 . . . **WILLIAM O. FAXON** has been elected a director and to the newly-created post of executive vice-president of *Tracerlab, Inc.* . . . **LEO R. MEAD**, technical assistant to the chief engineer of *Hallcrafters*, passed away suddenly at the age of 51. He had been with the company since 1950 . . . **LELAND G. STONE** has been named chief cabinet designer for *CBS-Columbia* . . . **ALBERT BRAND**, secretary-treasurer of *Radio Merchandise Sales, Inc.* died suddenly in New York at the age of 46. He was one of the founders of



RMS . . . E. K. FOSTER has been named group executive in charge of *Bendix's* radio, television and broadcast receiver, York, and Cincinnati divisions . . . *Electro-Voice, Inc.* of Buchanan, Michigan has appointed **CULLEN MACPHERSON** as assistant manager of the reproducing components division, **GEORGE R. RILEY** as assistant manager of the distributor sales division, **LLOYD W. LORING** as sales engineer, and **EVERETT E. LEEDOM** as advertising manager . . . **WARREN DEAN** has been named contract manager for *Crescent Industries, Inc.* of Chicago . . . **D. S. W. KELLEY** is now in charge of preparing electronic data and publications for *Allen-Bradley Co.* of Milwaukee . . . **RICHARD A. GRAVER**, vice-president and director of marketing for *Hallcrafters*, died recently in New York following a heart attack suffered during a business conference . . .

BENEDICT J. PARDINI has been named supervisor of the drafting and design group of *Cook Research Laboratories* of Chicago. He joined the firm in 1948 as a mechanical development engineer . . .

PAUL L. KUCH is now in charge of the advertising and sales promotion activities for *Tobe Deutschmann Corp.* . . . *Marshall Sales Company* has added **JOHN R. DAILEY** to its sales engineering staff . . .

A. E. KELEHER, JR. has been named product manager of *Raytheon's* communications equipment. He will also retain his post as staff assistant on the Waltham, Mass. electronic firm's product planning committee . . .

HOWARD D. TINDALL has been appointed manager of the transformer division of *Federal Pacific Electric Company*. His duties will also include the management of *Gardner Electric Manufacturing Company*, the firm's San Francisco subsidiary . . .

Winston Electronics, Inc. has appointed **WILLIAM PLATT** to the post of vice-president in charge of sales for its line of TV test equipment. . . . **S. GANGI** is the new general manager of *George Rattray & Co., Inc.*, manufacturers of precision potentiometers . . .

E. M. CAPPUCCI has been appointed director of sales for *Radio Merchandise Sales, Inc.* . . . The television and broadcast receiver division of *Bendix* has named **JOHN P. BROCKI** to the post of assistant service manager and **A. C. BOSS** as chief field engineer . . .

The Kay Electric Co. has appointed **JOHN GILMORE** to the post of general sales manager of its electronic instrument line . . . **SAMUEL OLCHAK** is the new general sales manager of *Regal Electronics Corp.* of New York . . . *Kay Lab* of San Diego has appointed **RICHARD REYBURN** to the post of chief of tests and **EARL CUNNINGHAM** to the TV camera equipment development department . . .

EDWARD S. MILLER has been named general manager of *Sherwood Electronic Laboratories* of Chicago. He will be responsible for the firm's new line of hi-fi equipment. He was associated with *The Radio Craftsmen* of Chicago for 7 years as chief engineer.

STYLED FOR SALES



Roto King



THE ONLY ROTATOR WITH THESE EXTRAS TO SELL!

SMARTLY STYLED CONSOLE WITH PIANO TUNING

The striking control console is designed for beauty of design as well as ease of operation. Actuates the rotator with the slightest touch. Available in mahogany or Ivory cabinet.



STOP WATCH TUNING ACCURACY

Pinpoint control system is unsurpassed in consistent accuracy of indication. Stops antenna instantly within $\frac{1}{2}$ degree of desired position. No drift or ambiguity.



POWERFUL INLINE DESIGN

Supports direct deadweight load of largest stacked array. Resists downthrust and bending moment. Built-in thrust bearings. No extra parts to buy. No breakable offset bearings.



REPLACEABLE FACTORY SEALED CARTRIDGE UNIT

Sealed power drive unit eliminates the former need of dismantling the antenna when servicing. Simply loosen 3 screws to remove the sealed unit.

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Close tolerance 3200:1 reverted gear drive (within .002 in. tolerance) efficiently transmits 100% of developed power. No inherently weak worm gears.

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390 DEGREE ROTATION

390 degrees—the broadest traverse range now in use—speeds and simplifies station selection beyond standard 360 degree revolution.



COLORFUL "CARRY-ALL" CARTON

Safely protects Roto-King en-route...eases on-the-job carrying of units...comes in handy in the shop or around the home. A JFD merchandising extra at no extra cost.



AUTOMATIC VOLTAGE COMPENSATION

Advanced circuitry achieves automatic voltage compensation for stability and exactness of indication despite line voltage fluctuations.

ROTO-KING IS LIKE A DIRECT LINE
TO EVERY TV STATION IN YOUR AREA.



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NO FUSS—Midgetrols cut replacement time to minutes. The round, tubular shaft is simple to cut to exactly the length you need . . . and it's easily adapted to split-knurl, flatted or set screw type knobs. Attaching an AC switch is a cinch, without taking the control apart.

NO KICK-BACKS—Midgetrols give your customers the long, trouble-free service that makes lasting friends. You can count on them for performance that equals or exceeds that of original equipment, because they're engineered to provide accurate resistance, superior stability, in any radio or TV set . . . in any climate.

NO DOUBT ABOUT IT—Midgetrols save you time and money. Your local Mallory distributor is ready to supply a special Mallory Control Kit that will set you up to service more than 50 models of radio and TV sets. You'll get a stock selected on the basis of set popularity in your own area . . . plus a free metal storage cabinet. Call your Mallory distributor today, or write to P.O. Box 1558, Indianapolis, Indiana.

BE SURE TO USE . . .



MALLORY POWER RHEOSTATS . . . vitreous enamelled, in ratings from 25 to 500 watts, with exclusive hinged contact arm for positive contact.



MALLORY DEPOSITED CARBON RESISTORS . . . high stability resistors with tolerances of 1% or 10% . . . at lower cost than wire-wounds.

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ONE of Barney's most consistent and attractive characteristics was his normal sunny disposition; so when Mac, his employer, stepped inside the service department after lunch and caught sight of Barney standing in the middle of the room with a most lugubrious and rueful look on his freckled countenance, it was quite a shock.

"Nothing could be as bad as you look," Mac hastened to say with conviction. "Pull in your lower lip before you step on it. What's wrong?"

Barney pointed wordlessly to an object on the bench. Looking closely, Mac saw it had been a small a.c.-d.c. radio with a red plastic cabinet; but now the top of the cabinet had softened and drooped down over the tubes and i.f. transformer cans so that they became so many formless bumps beneath the melted red sheet. The dial markings on the front of the cabinet were pulled and distorted in appearance like the face of one of the limp watches in a Dali painting.

"What did you do to that cabinet?" Mac demanded as his forehead creased in a frown.

"Now don't flip your lid," Barney said hastily. "I've already called the distributor long-distance and ordered a new cabinet which should be in tomorrow. Naturally, I'll pay for both the call and the cabinet."

"But how did you melt it down like that?" Mac persisted, a grin tugging at the corners of his mouth in spite of himself as he looked at Barney's woe-begone expression.

"This set will not stay in alignment. You can set the i.f. trimmers right on the nose, but after the set plays for a few minutes they drift out of line. I decided to see if heat was causing the trouble by turning our infrared spot light on this i.f. transformer can right here on the back of the chassis. Since this would take only a minute, I didn't bother to take the chassis out of the cabinet. Just as I set up the lamp, a customer came in the front door. I went to see what he wanted without turning off the lamp because I thought I'd be back in a sec or so.

"Well, he was one of those characters who insist on giving you a complete case history of his cigar-box receiver before he intrusts it to your tender care. I had to listen to its age, its many original virtues—including unmatched tone—the horrible tortures it had endured at the hands of other unscrupulous and unprincipled service technicians, and finally its present symptoms in the most minute detail. He finished his long-winded discourse with a little apple-polishing comment on how highly our service had been recommended to him and how sure he was that we would do him a splendid job at a very reasonable price. He was especially emphatic about this 'reasonable price' angle. To cut a long and painful story short, it took me a good quarter of an hour to hear him out; and when I suddenly remembered the heat lamp and dashed in here, I

MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



CABINET CRISIS

saw this gooey and disgusting mess."

"Well," Mac said slowly, "I guess it has taught you a lesson; so I suppose the store can absorb the cost of tuition. These new plastic cabinets require different handling than the Bakelite ones did. Remember that woman who brought in the kitchen receiver that had been melted down simply because she left it sitting on top of her stove too near the oven vent while she was baking? And there was that portable receiver case that practically ran into a puddle when it was parked too near the toaster on the breakfast table.

"Keep in mind these new cabinets are soft and have a high gloss that should be protected. Never turn one of them upside down or face down on a littered bench while you are removing the chassis screws. A sharp-cornered little piece of solder is all it takes to gouge a deep scratch in the soft surface. Always spread a clean, thick cloth down first. I've noticed in particular that you've got to be darned careful about using any cleaning fluid on these cabinets. Most of them are very allergic to either carbon tetrachloride or acetone. Wiping the surface of a cabinet with either of these will destroy the gloss and leave a sticky, lint-trapping smudge that can never be erased. It's a good rule never to use anything but mild soapy water to clean plastic cabinets of any sort. This may be a little slower, and you have to stir in more elbow grease, but it is much safer."

"I'm convinced the only foolproof procedure is to get the chassis out of the cabinet as quickly as possible and then to store the cabinet in a safe place while you work on the set," Barney said earnestly. "A mere dab with a hot solder gun tip will put a deep dent in one of these new jobs. I notice

a lot of our customers do not want to go for the price of a new cabinet when the old one is cracked. They expect us to glue the crack together. Temporarily, you can do a pretty neat job by coating the broken edges with speaker cement and then pressing them together, but I notice that after a while the crack opens up, especially after the cement dries out. Is there any good way of preventing this?"

"I've had pretty good luck in gluing a thin strip of heavy cheesecloth along the crack inside the cabinet with a good wood adhesive," Mac offered. When the glue sets in the meshes of the cheesecloth, it produces a sort of unyielding patch bonded right to the cabinet that prevents the crack from spreading. At least cabinets are coming into the shop that I repaired in this way two and three years ago, and they are still OK."

"Hey, what have you got there?" Barney broke in as he noticed a half dozen flat little cardboard boxes in Mac's hand.

"These are Dubbings new D-210 'Plus-50' Music and Test Tape Samplers," Mac answered. "Each consists of a three-inch reel generously filled with about 275 feet of Reeves Mylar base 1-mil-thick tape that is advertised as being impervious to temperature and humidity and practically indestructible. The tape is recorded at 7½ ips, full-track, with two timing beeps, a fifteen-second 5000 cycle tone, and about six and a half minutes of high-fidelity music recording, including Bizet's *Carmen Overture* and Rimsky-Korsakov's *Song of India*."

"What are you going to do with them? You've already got that Dubbings professional test tape that you're so fussy about."

(Continued on page 142)

The Model
TV-50

GENOMETER

A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:

A. M. Radio

F. M. Radio

Amplifiers

Black and White TV

Color TV



7 Signal Generators in One!

- ✓ R. F. Signal Generator for A.M.
- ✓ R. F. Signal Generator for F.M.
- ✓ Audio Frequency Generator
- ✓ Bar Generator
- ✓ Cross Hatch Generator
- ✓ Color Dot Pattern Generator
- ✓ Marker Generator

SPECIFICATIONS:

R. F. SIGNAL GENERATOR:

The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics. Accuracy and stability are assured by use of permeability trimmed Hi-Q coils. R.F. is available separately, modulated by the fixed 400 cycle sine-wave audio or modulated by the variable 300 cycle to 20,000 cycle variable audio. Provision has also been made for injection of any external modulating source.

VARIABLE AUDIO FREQUENCY GENERATOR:

In addition to a fixed 400 cycle sine-wave audio, the Model TV-50 Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal. This service is used for checking distortion in amplifiers, measuring amplifier gain, trouble shooting hearing aids, etc.

BAR GENERATOR:

This feature of the Model TV-50 Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50 employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

CROSS HATCH GENERATOR:

The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect. This service is used primarily for correct ion trap positioning and for adjustment of linearity.

DOT PATTERN GENERATOR (For Color TV)

Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence. When all controls and circuits are in proper alignment, the resulting pattern will consist of a sharp white dot pattern on a black background. One or more circuit or control deviations will result in a dot pattern out of convergence, with the blue, red and green dots in overlapping dot patterns.

MARKER GENERATOR:

The Model TV-50 includes all the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions. Only

\$47⁵⁰
NET

SHIPPED ON APPROVAL NO MONEY WITH ORDER — NO C.O.D.

Try it for 10 days before you buy. If completely satisfied then send \$11.50 and pay balance at rate of \$6.00 per month for 6 months. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-110, 3849 Tenth Ave., New York 34, N.Y.
Please rush me Model TV-50. I agree to pay \$11.50 within 10 days and to pay \$6.00 per month thereafter. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name
Address
City Zone State



Superior's new
Model 670-A

SUPER METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS
CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henrys 7 to 7,000 Henrys
DECIBELS: -6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.

\$28⁴⁰
NET



Superior's new
Model TV-11

TUBE TESTER

SPECIFICATIONS:

- ★ Tests all tubes including 4, 5, 4, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyatron, Miniatures, Sub-Miniatures, Novels, Sub-minors, Proximity fuse types, etc.
- ★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
- ★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible

- to damage a tube by inserting it in the wrong socket.
- ★ Free-moving built-in roll chart provides complete data for all tubes.
- ★ Newly designed Line Voltage Control compensates for variation of any Line Voltages between 105 Volts and 130 Volts.
- ★ NOISE TEST: Phone-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The Model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

\$47⁵⁰
NET

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscil-

lator incorporated in this model will detect leakages even when the frequency is one per minute.

SUPERIOR'S NEW MODEL TV-40



C.R.T. TUBE TESTER

★ A complete picture tube tester for little more than the price of a "make-shift" adapter!!

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test each tube: that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

EASY TO USE:

Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

★ Tests all magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

SPECIFICATIONS:

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Tests for open elements.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only . . .

\$15⁸⁵
NET

**SHIPPED ON APPROVAL
NO MONEY WITH ORDER — NO C.O.D.**

Try any of the above instruments for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. **No Interest or Finance Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.

Dept. D-110 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

□ Model 670-A Total Price **\$28.40**
\$7.40 within 10 days. Balance \$21.00
monthly for 6 months.

□ Model TV-11 Total Price **\$47.50**
\$11.50 within 10 days. Balance \$36.00
monthly for 6 months.

□ Model TV-40 Total Price **\$15.85**
\$3.85 within 10 days. Balance \$12.00
monthly for 6 months.

SURPLUS BARGAINS

Correll-Dublier, 70 MFD, 220 VAC (660 VDC)
Oil Condenser.
Brand New \$4.75 ea.

100,000 Ohm, 100 Watt Wire 59c ea.
Wound Adjustable Slider Resistor 3 for \$1.49

OIL CONDENSER SPECIALS

Brand New, Ceramic Ins.
1 MFD 2000 VDC \$1.25
2 MFD 1500 VDC 3.25
3 MFD 8000 VDC 1.50
4 MFD (500 VDC, 2 MFD 800 VDC, 2 MFD 600 VDC) 1.90

MINIATURE METER

0-500 Microamps, 1 1/2" scale, Bakelite case. An accurate tiny meter ideal for 60 meters, SWR bridges, etc.
Brand New \$3.75 ea.
2 for \$9.50

AMERTRAN PLATE TRANSFORMER

Pri. 115 V, 60 cy, Sec. 1120-0-1120 Volts @ 600 ma. CTS. Full cast aluminum case.
Brand New \$14.95

EIMAC VACUUM CONDENSERS

33,000 VDC
12 MFD (VDC 12-33) \$9.50

MOBILE DYNAMOTOR

6 Volt DC Input, 425 Volts @ 375 ma Output.
Made by Kier and Planner \$27.95 ea.

PANEL METERS

GOVT SURPLUS, G.E., WESTINGHOUSE, WESTERN ELECTRIC, SIMPSON, ETC.
2" METERS
0-4 amp AC \$2.95
0-50 ma AC 2.95
0-10 ma AC 2.95
0-15 ma AC 2.95
3" METERS
0-500 Microamps \$6.95
0-400 Microamps 5.95
0-500 Microamps 5.95
0-200 Milliamps 4.95
0-350 Milliamps 4.95
0-5 Milliamps 3.95
3" METERS
0-500 Microamps \$5.95
0-50 Mill. 3.95
0-40 Mill. 4.95
0-150 Volts AC 4.95
0-750 Volts AC 5.95
0-15 Volts DC 4.95
0-1.5 Mill. 3.95

THE GREATEST METER BUY EVER!

READ THIS: Westinghouse 3" Meter, Standard Type N335, Round Bakelite Case, 0-5 amps DC. Range 10 ma. can be easily converted other mill. rcp. 100
OUR PRICE ONLY \$2.49

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4 MFD-500VDC	5.95	4 MFD-2000VDC	53.95
10 MFD-500VDC	1.50	6 MFD-2000VDC	4.95
2 MFD-1000VDC	.95	2 MFD-2500VDC	4.95
3 MFD-1000VDC	1.55	4 MFD-2500VDC	5.95
5 MFD-1500VDC	2.65	4 MFD-3000VDC	6.95
5 MFD-1500VDC	2.65	3 MFD-7500VDC	1.75
6 MFD-1500VDC	2.95	3 MFD-8000VDC	24.95
10 MFD-1500VDC	3.75	50000 MFD-35KV	5.50
3 MFD-3000VDC	2.95	5 MFD-500VAC	2.95

G. E. RELAY CONTROL

(Ideal for Model Controls, Etc.)
Contains a sigma midjet 8,000 ohm, relay (trips at less than 2 MA), high impedance choke, bimetal strip, neon pilot and many useful parts. The sensitive relay alone is worth much more than the total
low price of \$1.25 Each 10 for \$9.90

G. E. TEST INSTRUMENT

Contains General Electric 0-100 microampere meter. Portable metal case 8"x4 1/2"x3 1/2". Ideal for conversion to grid dip meter, field strength meter, antenna scope, etc.
BRAND NEW \$7.95

MOBILE RELAY

6 VDC Coil SPST, 30 amp contact for Dynamotor starter plus extra contacts for signaling receiver, SPST normally closed. Made by Struthers Dunn. Specially priced at \$9.95 ea.

WIRE WOUND RESISTOR KIT. 25 popular assorted-5, 10, 50, 100 watt \$1.95

READ 'N' SAVE BARGAINS

6 Heavy 80 ma chokes	.....	.85
9 ohm 100 watt non-inductive resistor	.....	2.50
20 ohm 55 watt non-inductive resistor	.....	2.50
25 ohm 55 watt non-inductive resistor	.....	2.50
15V AC relay SPST 15 Amp contacts	.....	1.75
250V AC relay SPST 15 Amp contacts	.....	1.75
.01 ohm, 100V VDC Mima	.....	3 for .95
.004 3500 VDC Mima	.....	3 for .95
.04 500 V Mima	.....	3 for .95
100,000 ohm 100 watt resistor45

Min. Order \$3.00-25% with Order-F.O.B. New York.

PEAK ELECTRONICS CO.

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Phone WO 2-5439

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

THE high degree of community confidence that can be earned by an aggressive service association was recently demonstrated in the city of Detroit, Michigan.

The city of Detroit applied for and got educational channel 56. The project is rated as the most heavily endowed educational TV station in the country. It received a huge contribution from the Ford Foundation and substantial contributions from practically every industrial, civic, and educational group in the city. However, experience has shown that in areas that are served well by v.h.f. broadcast stations, set owners are lethargic in the matter of spending more money to receive u.h.f. stations.

The executive committee that heads up the organization back of Detroit's channel 56 took a realistic view of the selling problems it faced to get TV set owners to convert their sets to receive the u.h.f. channel. They selected the Television Service Association of Michigan (TSA) to spearhead the drive to sell the u.h.f. channel to Detroit set owners. Al Weiss, president of the Television Service Association, who had been appointed a member of the Detroit Educational TV Executive Committee several months before, was assigned the responsibility of working out the technical problems involved in selling the station effectively.

One of the projects which TSA will handle is that of testing and recommending conversion equipment to set owners. Another phase of the TSA assignment is to enlist the cooperation of manufacturers, parts jobbers, set distributors, and other service groups to help sell the station to the public.

Early in January the Association played host to a galaxy of Detroit's industrial, civic, and educational leaders along with a score of nationally prominent television figures to trigger the program that will provide a viewing audience for the city's u.h.f. educational channel.

The continuing success of the Television Service Association of Michigan indicates what can be accomplished when most of the leading serv-

ice businesses in an area cooperate in programs that are for their mutual benefit by pooling their efforts in a service association. TSA has never been a "one man" organization. It has benefited through the willing acceptance of association responsibilities by practically all members of the group. Its programs have been dynamic and positive and the association has cooperated wholeheartedly with other industry elements in all programs that were in the best interests of the industry as a whole.

RTSA V.H.F. Cooperation

Another fine gesture of cooperation was recently initiated by the Radio Television Servicemen's Association of Pittsburgh, Inc.

Pittsburgh's educational TV station WQED, operating on channel 13, has had some difficulty in building its viewing audience. The station's chief engineer, Ed Horstman, told members of RTSA that, "Many people who are not receiving our signal are unaware of the fact that their sets need only a slight tuning adjustment to receive our broadcasts. We need to correct this unfortunate misconception of WQED's receivability in our signal area."

The executive board of the Association, under the chairmanship of John F. Cochran, voted unanimously to sponsor a program called the "Tuning Adjustment Project for WQED." This project provides for the Association to adjust 25 carefully chosen receivers in the borough of Forest Hills. To carry out the program, WQED will furnish the names and addresses where calls are to be made and the RTSA members will attempt to adjust these sets for channel 13 reception. If it is found necessary to replace a receiving tube, it will be charged for at the normal list price. However, if major repairs are required, the RTSA technician will first inquire whether the set owner has a regular TV service technician. If so, the customer will be advised to call the regular service technician to handle the adjustments. If the customer does not have a regular TV service technician, the RTSA member handling the job will offer his services at his established rates for labor and

parts. When the call is completed, the Association technician will mail his report to the engineering department of WQED.

Minnesota Story

Late last year service shop operators in Minnesota received an invitation to attend the first meeting of the newly formed Minnesota Television Service Engineers, Inc. The announcement of the meeting read:

"The Department of Business Development together with the Industrial Commission of the State of Minnesota are sponsoring the establishment of a state-wide organization for persons engaged in the business of television and radio service. The name of this Association is Minnesota Television Service Engineers, Inc.

"In its effort to be of service to the electronic industry by helping it to help itself, these two departments of the State of Minnesota are suggesting that all those people who are in this business today should become members of this organization now, if they are interested in taking steps which are vital to their development."

The organizers are several members of the Radio Television Service Associations of Minneapolis and St. Paul, who were joined later by members from other service associations. A broad plan of activity identification has been offered for service industry acceptance by the Minnesota Television Service Engineers, Inc. (MINTSE). John Hemak, chairman of the newly formed MINTSE, presented a complete program of standards which was originally developed by the Standards Committee of NATESA, of which he has been chairman since 1951.

In a letter explaining the MINTSE program, Mr. Hemak said: "Certain requirements must be met by individuals in this business. A 'Certificate of Recognition' will be issued. If not adhered to, the possessor would be guilty of (violating) the Minnesota Fraudulent Advertising Law. The definitions are enhanced by the establishment of an apprenticeship training program with the Minnesota Industrial Commission where time, age, and educational qualifications must be met. The Minnesota Television Service Engineers, Inc. will have all technical and business information on file to verify qualifications of all its members."

In essence, the MINTSE program embraces the following objectives: "Membership will be open to everyone connected with the trade as technicians, service managers, servicemen, specialists, assistants, etc. A training program for those entering the service field will be conducted by the apprenticeship committee of the association with the cooperation of the Bureau of Apprenticeship of the U. S. Department of Labor and the Industrial Commission of Minnesota.

"Improvement of public relations will be the assignment of another committee so that the radio listener or TV viewer will know the qualifications and

RADIO • TELEVISION • INDUSTRIAL ELECTRONICS

THIS professional TRAINING IS THE KIND THAT Really Pays Off!

... and it costs only a fraction
of what you might expect to pay!

**FIX ANY RADIO OR TV SET EVER
MADE...easier...better...faster**

Backed by the how-to-do-it methods so clearly explained in this one big 622-page book, you'll be prepared for fast, accurate service on any radio or television receiver ever made.

Best of all, the cost is only \$6.75 (or see money-saving combination offer in coupon).

Radio & Television TROUBLESHOOTING AND REPAIR by Ghirardi & Johnson is far and away the world's most modern, easily understood guide. Step by step, it takes you through each service procedure... from locating troubles with less testing to repairing them promptly by fully-approved professional methods... the kind that enable you to handle tough jobs as slick as you now do the easy ones.

COMPLETE SERVICE TRAINING

For beginners, this giant book is a complete service training course. For experienced service-

men, it is a quick, easy way to "brush up" on specific jobs; to develop better methods and shortcuts and to find fast answers to tough jobs.

Here are just a few of the subjects covered: Components and Their Troubles; Basic Troubleshooting Methods; "Static" and "Dynamic" Testing; Practical Troubleshooting Tips and Ideas; AC/DC, 3-way Portable and Battery Set Troubleshooting Problems; Servicing Communications Receivers; A Complete Guide to Television Service: AM, FM, and TV Realignment Made Easy; Resistor, Capacitor, Inductor and Transformer Problems; Servicing Tuning, Selector and Switching Mechanisms; Loudspeakers; Servicing Recorders and Record-playing Equipment... and dozens more. 417 illustrations. Read TROUBLESHOOTING AND REPAIR for 10 days AT OUR RISK!

**LEARN BASIC CIRCUITS FULLY...and
watch service "headaches" disappear**

It's amazing how much easier and faster you can repair radios, television sets and even industrial electronic equipment when you know all about circuits and what makes each one "tick."

You locate troubles in a jiffy because you know what to look for and where to look.

You make repairs lots faster, better and more profitably!

Actually, there are only a comparatively few BASIC circuits in modern equipment. Radio & Television RECEIVER CIRCUITRY AND OPERATION by Ghirardi and Johnson gives you a complete understanding of these as well as their variations. It teaches you to recognize them... to under-

stand their peculiarities and likely "troubles-jots"... and shows how to eliminate useless testing and guesswork in making repairs.

LEARN MORE—EARN MORE!

Throughout, this 666-page book with its 417 clear illustrations gives you the kind of above-average professional training that fits you for the better, big pay jobs in either servicing or general electronics. Covers all circuits in modern TV and radio receivers, amplifiers, phono-pickups, record players, etc. Price only \$6.99... or see money-saving offer in coupon. Examine it 10 days at our risk!

**The books that
REALLY SHOW
YOU HOW!**

More radio-TV technicians have trained from Ghirardi books than any others of their kind! Almost 1300 pages and over 800 pictures and diagrams in these two new books explain things so clearly it's next to impossible for you to go wrong. Each book is strictly up-to-the-minute... NOT a re-hash of old, out-moded material.

FREE EXAMINATION...easy terms!

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Send books indicated for FREE EXAMINATION. In 10 days, I will either remit price indicated plus postage or return books postpaid and owe you nothing.

☐ Radio & TV TROUBLESHOOTING AND REPAIR (Price \$6.75) ☐ Radio & TV CIRCUITRY AND OPERATION (Price \$6.99)

☐ COMBINATION OFFER... Both books only \$12.00 (Regular price separately \$12.75... you save \$1.25)
(Combination offer is payable at rate of \$3 (plus postage) after 10 days if you decide to keep books, and \$3 a month thereafter until \$12 has been paid.)

Name.....

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City, Zone, State.....

OUTSIDE U.S.A. \$7.85 for TROUBLESHOOTING & REPAIR; \$7.00 for CIRCUITRY & OPERATION; \$13.00 for both books.
Cash with order, but money refunded if you return books in 10 days.

Announcing the NEW SANGAMO Type 36

PLUG-IN TUBULAR PAPER CAPACITOR



Your answer to those calls for a PRINTED CIRCUIT REPLACEMENT CAPACITOR

Perhaps you've already had calls for printed circuit replacement capacitors. Now you can offer your customers the first mass produced capacitors for printed circuit chassis. Remember, the new Type 36 plug-in tubular is an exact replacement for most of today's new printed circuit chassis. To stock up now, see your Sangamo jobber or write direct.



**MOISTURE-
RESISTANT
END FILL**



**BAKELITE
MOLDED CASE**

**LEADS ARE CUT
AND PROPERLY
SPACED TO FIT**

Exact replacement
in most of today's
printed circuit chassis



SANGAMO ELECTRIC COMPANY

MARION, ILLINOIS

the limits of knowledge and services to be expected of the person called to perform repairs to the set.

"Preventive maintenance practices, standardization of services, exchange of service and repair information, improvements in service procedure, all will tend to give the customer better and longer service from his set at the same or lower over-all cost."

The original organizing committee includes Harold Simonson, Forest Reine, Warren Schei, Robert Rohweder and John Hemak, representing five communities in the state. Since then, the Board of Directors has been expanded to include a representative from each Congressional District.

Eight occupational classifications are proposed in the MINTSE program. Five of these classifications are recognized for full-fledged participants in the service industry, qualified to become members of the organization. In the recommended order of importance, these five are: (1) service engineer; (2) service manager; (3) technician; (4) serviceman, and (5) specialist. Three classifications are provided for those qualified to participate in service work under supervision but who are not eligible for membership in the Association. These are: (1) apprentices, (2) students, and (3) technical assistants.

KADA of Kansas

One of the most interesting developments in the field of association work has been happening in Kansas during the past year.

During the past few years, the Wichita Appliance Dealers Association has developed an outstanding record of successful programs and activities in the interest of their members and for the good of the television and appliance retailing industry in the Wichita area. On the heels of this successful record, they organized the Kansas Appliance Dealers Association for the benefit of dealers throughout the state.

In reporting on its activities for the past year in the Association's house organ, "The Yardstick," Jack Hughes, dynamic manager of the organization, said:

"During this past year we have organized and made operative a state association of appliance dealers. We have held another successful dealer clinic. We have organized groups of appliance dealers in several of our various cities. We have held a successful promotion — state wide — for appliance dealer members. We have organized and made operative a servicemen's division of the Wichita Appliance Dealers Association, that may well be emulated throughout the state. We have again proven conclusively that appliance dealers can and will work together for the common good. This in itself may be considered a major accomplishment, since recognized authorities have said that the spotlight is on Kansas Appliance Dealer Association, and that Kansas has one of the outstanding associations

in the entire nation. That fact alone indicates the degree and quality of the progress we have made."

The formation of the technician's division of the Wichita Appliance Dealer's Association is a clear example of the healthy trend among dealers and service shop operators to work together on programs that are for their common good. Service people are finding that the evils of indiscriminate discount selling affect them as much as it does the legitimate dealers. This is but one of the many problems that affect dealers and service people with equal force.

The outstanding record of success piled up by WADA and KADA demonstrates clearly again what can be accomplished in trade associations when a competent manager is employed to devote his full time to association work. C. D. "Jack" Hughes, manager of WADA and KADA, has prepared a manual on the subject of "How to Organize and Operate a Small Association." Information about it can be obtained by writing to C. D. Hughes, KADA, Inc., 815 Central Building, Wichita, Kansas.

RTG of Long Island

Still using the aggressive tactics that have sparked their unusual growth in the past few years, the Radio Television Guild of Long Island put on a lively campaign late last year in the selection of a slate of officers to head the association for the year ahead. To make certain that every member of the organization had an opportunity to participate in the election, ballots were mailed to all members. The result was a record vote and a record attendance at their December meeting to hear the results of the balloting.

Murray Barlowe was elected president of the Guild. Officers elected to serve with him include: Jim Lyons as vice-president; Chris Stratigos as corresponding secretary; Bob Henderson as recording secretary; Jim Thornton as treasurer; and George Volkens as sergeant-at-arms. Trustees elected for Nassau are Art Cyr, Jack Wheaton, and Ralph Raynor. Queens trustees elected included Chet Amble, Jim Clifford, Sam Pristas, Henry Rogers, and Len Silverman. The five trustees elected for Suffolk are George Knoldl, Sam Margolis, H. McDonald, Gerry Rawlins, and Fred Strickland.

The organization publishes an interesting monthly house organ called the "Guild News." It receives good advertising support from independent parts jobbers who serve Long Island. Associations who are thinking of starting house organs of their own could pick up some good ideas by subscribing to the "Guild News." The address of the organization is: RTG of Long Island, Box 87, Bethpage, N. Y.

TRA of Alameda County

Another association that completed a very successful year is the Television Radio Association of Alameda

... and if you need
**PLUG-IN
 ELECTROLYTICS**
Sangamo's got them too!



Your answer to those calls for a PRINTED CIRCUIT REPLACEMENT CAPACITOR

You're bound to have more calls for plug-in electrolytic replacement capacitors for printed circuit chassis because more and more manufacturers are using printed circuits in the assembly of their television receivers.

Sangamo's dry electrolytic plug-in capacitors are exact replacements for most of the new sets with printed circuit chassis. Stock up now!

See your Sangamo jobber or write to us direct.



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 MARION, ILLINOIS

SC55-4

WHEN CORROSION ATTACKS PERMA-TUBE STAYS CLEAN

... and so does your reputation

**J&L
M**

Look for this brand mark
—only genuine Perma-Tube
gives you this protection

Here's why PERMA-TUBE backs up quality service:

1. **PERMA-TUBE IS CORROSION-PROOF** . . . it's treated with vinylite—then coated inside and outside with a metallic vinylite base. It's guaranteed to be free from rust in a salt spray test of 500 hours minimum to an American Society of Testing Materials Specification B117-49T. This assures long life.
2. **PERMA-TUBE IS STURDY** . . . it's made of special, high-strength J&L Steel.
3. **PERMA-TUBE IS EASILY INSTALLED** . . . it's the only mast with both ends of the joint machine fitted.

Here's proof of how PERMA-TUBE resists corrosion:



Test samples after 1440 hours
ASTM salt spray test

1. Coated Mechanical Tubing . . . note that galvanized coating is gone and underlying steel is severely corroded.
2. Coated Mechanical Tubing . . . note that paint coating is nearly destroyed and zinc coating is corroded.
3. Galvanized Mechanical Tubing . . . note zinc and steel are corroded.
4. PERMA-TUBE . . . note that Perma-Tube is relatively unharmed.

**J&L
STEEL**

For further details on product and installation, write for a copy of the Perma-Tube booklet. Jones & Laughlin Steel Corporation, Dept. 495, 3 Gateway Center, Pittsburgh 30, Pa.

Jones & Laughlin
STEEL CORPORATION — Pittsburgh

County, Oakland, California. In reporting on their progress during the year, Ernest S. Copley, editor of the organization's house organ "TV Flash-es," paid tribute to the first Board of Directors in an editorial "We Salute the Few." In this, he pointed out that: "Except for the perseverance and dogged determination of a few men, perhaps like so many organizations have in the past, the infant which is our Association today would have withered and died in a few short months."

"But despite the discouragement and inertia of a weak membership, despite lack of funds and the resultant problems, these men kept arguing and pleading for an association and the benefits which derive from group effort . . ."

ITTA of Indianapolis

The Indianapolis Television Technicians Association is planning to use an unusual type of service selling program to acquaint Indianapolis set owners with the association's emblem and to sell service.

The success of the promotional campaign to sell outdoor antennas that was sponsored by TV Station WTTV in Bloomington, Indiana, demonstrated that set owners will buy TV service and accessories if there is enough drive back of the sales effort. Officers of ITTA are working with members of the TTLB staff in the preparation of an association service selling campaign that has an entirely different approach in promoting ITTA members' businesses than those normally used by associations. The Bureau will be furnished detailed information about the successes achieved in the use of various phases of this promotion. Information on the results obtained will be made available to other associations by the TTLB.

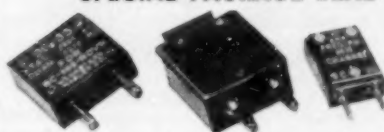
This should be a very good business year for those service shops whose owners have learned how to promote their facilities and know-how. It will be a *selling year* for all types of businesses, for the public will continue to be "cagey" about spending its available money.

Your editors would like to make available to readers of this department information about simple promotional plans that have proven successful. If you have been using a plan or a "gimmick" that brings service jobs into your shop, write and tell us about it. Share your successful promotional ideas with your fellow electronic service technicians by writing to: Special Services Editor, TTLB, P. O. Box 1321, Indianapolis 6, Indiana.

Central Television Service of Chicago has graciously made available a supply of its new booklet "Why Television Antennas?" for distribution to service businessmen who are interested in promoting the sale of outdoor antennas. If you would like to have a copy of this booklet send a *stamped and addressed envelope* to TTLB, P. O. Box 1321, Indianapolis 6, Ind. —30—

RADIO & TELEVISION NEWS

Genuine Govt. Surplus Crystals!
Same day shipment!
Assorted frequencies!

SPECIAL PACKAGE DEAL NO. 1

100

MIXED FREQUENCIES! AT LEAST 20 HAM BAND FREQUENCIES! TO OPERATE ON 160, 80, 40, 20, 10, 6, AND 2 METERS FOR OPERATION ON FUNDAMENTAL OR HARMONIC FREQUENCY.

SPECIAL PACKAGE DEAL NO. 1 CONSISTS OF:

80.....FT-243 10.....FT-171 10.....DC-34-35

SHIPPING TERMS: Same day shipment! Shipping wt.: 3½ lbs. Check your postal zone and add sufficient postage to cover cost of mailing.

NOTE: Owing to low price, crystals in Package Deal No. 1 are not subject to operational guarantee.

SPECIAL PACKAGE DEAL NO. 1 **\$9.95** Regular value \$49.00

SPECIAL PACKAGE DEAL NO. 2

Guaranteed to oscillate!	Consists of 5 choice crystals:
MINI MODEL DC-18-A, 1.000 KC	1—RH-5 MILLEY, 10,000 KC Reg. Value \$1.99
TTL: Built-in 15 V. automatic	1—PT-243, 5,000 KC Reg. value..... 1.99
oscillator controlled heating unit.	1—DC-18, 200 KC Reg. value..... 1.99
General base. Regular value..... \$9.99	1—PT-241, 500 KC Reg. value..... 1.99

Total regular value \$13.91.

\$8.95 POSTPAID

SPECIAL PACKAGE DEAL NO. 3 For single side band
36 FT-241 LOW FREQUENCY CRYSTALS!

Frequency range from 370.370 Kc. to 435.185 Kc. in steps of every 1.852 Kc. approximately. Channels: 0 to 35.

NOTE: Owing to low price, crystals in Package Deal No. 2 are not subject to operational guarantee.

SPECIAL PACKAGE DEAL NO. 3 **\$3.95** POSTPAID
Regular value \$14.04

SPECIAL PACKAGE DEAL NO. 4

THE BIGGEST CRYSTAL BARGAIN EVER OFFERED! CONSISTS OF:

1 Special Package No. 1, Reg. value \$9.95	1 Special Package No. 3, Reg. value \$3.95
1 Special Package No. 2, Reg. value 8.95	Total value \$22.85

SPECIAL PRICE FOR ALL 3 PACKAGES..... \$19.95 POSTPAID!

INDIVIDUAL CRYSTALS!

Guaranteed to oscillate!
Your choice of frequencies!
Same day shipment!

**ALL CRYSTALS TESTED FOR ACTIVITY!
1-DAY SERVICE FOR EVERYTHING IN STOCK!**

NOVICE BAND **FT-243 FUNDAMENTAL FREQUENCIES**

Lots of 10 or more. Ea. **99c**
Individually. Ea. \$1.25

YOUR CHOICE OF FREQUENCIES!

80 METERS 3701, 3702, 3703 through 3748
in steps of 1 KC.

40 METERS 7176, 7177, 7178 through 7198
in steps of 1 KC.

DOUBLING TO 3588, 3589, 3590 through 3599
40 METERS: in steps of 1 KC.

SINGLE SIDE BAND—FT-241-A

Low Frequency Crystals 79c

Lots of 10 or more. Each.....	75c
Lots of 5 or more. Each.....	85c
Individually, Each.....	90c

400	442	446	450	453	456	459	463	466	470	474	477
480	444	447	451	454	457	461	464	468	472	475	479
441	445	448	452	455	458	462	465	469	473	476	480

MISCELLANEOUS & SHIP BAND FREQUENCIES

[illegible]

NUMBERS LISTED ARE FUNDAMENTAL
FREQUENCIES IN KILOCYCLES

FT-243 Lots of 10 or more, Ea.
Lots of 5 or more, Ea. 79c
Individually, Ea. 99c **69c**

1015	2490	2960	310	4495	5860	6502	7377	7340	7873	8100	8375	8566	7
1016	2495	2965	310	4505	5872	6523	7373	7341	7875	8105	8380	8570	7
1129	2505	2975	310	4510	5880	6540	7383	7350	7880	8110	8390	8573	3
1156	2510	2980	315	4500	5897	6550	7391	7350	7883	8110	8390	8573	3
1195	2515	2985	315	4510	5905	6560	7395	7350	7885	8110	8390	8573	3
1220	2520	2990	320	4520	5915	6572	7400	7360	7890	8120	8395	8573	3
1980	2535	2995	320	4530	5925	6580	7400	7360	7890	8120	8395	8573	3
1915	2540	2995	3210	4540	5935	6585	7405	7370	7900	8120	8395	8573	3
1940	2545	3000	3210	4550	5945	6595	7410	7370	7905	8120	8395	8573	3
1965	2550	3005	3220	4560	5955	6600	7415	7370	7910	8120	8395	8573	3
1990	2555	3010	3225	4570	5965	6610	7420	7370	7915	8120	8395	8573	3
2020	2560	3015	3230	4580	5975	6620	7425	7370	7920	8120	8395	8573	3
2045	2565	3020	3235	4590	5985	6630	7430	7370	7925	8120	8395	8573	3
2070	2570	3025	3240	4600	5995	6640	7435	7370	7930	8120	8395	8573	3
2095	2575	3030	3245	4610	6005	6650	7440	7370	7935	8120	8395	8573	3
2120	2580	3035	3250	4620	6015	6660	7445	7370	7940	8120	8395	8573	3
2145	2585	3040	3255	4630	6025	6670	7450	7370	7945	8120	8395	8573	3
2170	2590	3045	3260	4640	6035	6680	7455	7370	7950	8120	8395	8573	3
2195	2595	3050	3265	4650	6045	6690	7460	7370	7955	8120	8395	8573	3
2220	2600	3055	3270	4660	6055	6700	7465	7370	7960	8120	8395	8573	3
2245	2605	3060	3275	4670	6065	6710	7470	7370	7965	8120	8395	8573	3
2270	2610	3065	3280	4680	6075	6720	7475	7370	7970	8120	8395	8573	3
2295	2615	3070	3285	4690	6085	6730	7480	7370	7975	8120	8395	8573	3
2320	2620	3075	3290	4700	6095	6740	7485	7370	7980	8120	8395	8573	3
2345	2625	3080	3295	4710	6105	6750	7490	7370	7985	8120	8395	8573	3
2370	2630	3085	3300	4720	6115	6760	7495	7370	7990	8120	8395	8573	3
2395	2635	3090	3305	4730	6125	6770	7500	7370	7995	8120	8395	8573	3
2420	2640	3095	3310	4740	6135	6780	7505	7370	8000	8120	8395	8573	3
2445	2645	3100	3315	4750	6145	6790	7510	7370	8005	8120	8395	8573	3
2470	2650	3105	3320	4760	6155	6800	7515	7370	8010	8120	8395	8573	3
2495	2655	3110	3325	4770	6165	6810	7520	7370	8015	8120	8395	8573	3
2520	2660	3115	3330	4780	6175	6820	7525	7370	8020	8120	8395	8573	3

FT-243	Lots of 10 or more, Ea.,	34c	
	Lots of 5 or more, Ea.,		39c
	Individually, Ea.,		49c

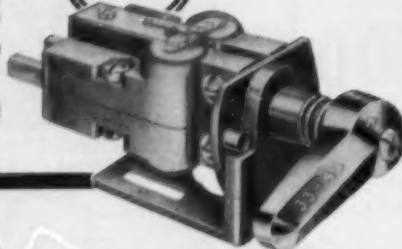
4035	4980	5660	5773	5880	6273	6400	6725	6875	7475	7673	7825
4080	5030	5675	5780	5880	6275	6400	6750	6800	7500	7673	7812
4165	5105	5700	5840	5940	6340	6475	6775	6825	7525	7700	7850
4190	5180	5790	5930	5990	6325	6473	6780	6850	7573	7725	7866
4255	5245	5850	5950	6050	6450	6500	6800	6875	7575	7725	7865
4357	5347	5950	6050	6150	6550	6600	6900	7000	7600	7750	7890
4490	5500	6100	6200	6300	6700	6750	7050	7100	7700	7850	7990

TERMS: All items subject to prior sale and change of price without notice. Minimum order: \$2.50. ALL crystal orders MUST be accompanied by check, cash or M.O. WITH PAYMENT. IN FULL. NO C.O.D. Postpaid shipments in U.S. and possessions only. IN FOREIGN INDIVIDUAL CREDIT IS NOT APPROVED. \$5.00 PER ORDER FOR POSTAGE. Also indicate second choice frequencies whenever substitution may be made. Calif. license add sales tax.

805 SOUTH UNION AVENUE
LOS ANGELES 17, CALIF.

RECOTON magnetic turnover cartridge

Goldring



gives you
unsurpassed
audio
performance!

Recoton features:

- Replaceable diamond or sapphire stylus.
- Frequency response of 20 to 16,000 cps.
- Added shielding
- High compliance and low mass
- Independent safety stylus assembly
- Minimum vertical motion
- Simple installation

Name your own standards! There is no cartridge made that excels the new RECOTON-GOLDRING.

You can enjoy all the advantages of low output while eliminating hum pickup from changer motor, transformer, etc. The answer is in Recoton's newly developed **push pull coil assembly**. So thrill to a new experience in listening pleasure with this amazing turnover cartridge. It gives a performance that will satisfy even the most critical hi-fi enthusiast! And its modest price of **\$9.90** (including 2 sapphire stylus) comes as a pleasant surprise!

Sold by all leading hi-fi distributors. For more detailed literature and name and address of distributor nearest you, write to Dept. R

RECOTON CORPORATION • 147 W. 22nd Street • New York 11, N. Y.
Manufacturers of World Famous Diamond, Sapphire, Osmium Phono Stylus

LONG-PLAYING (33 1/3 R.P.M.) HI-FIDELITY

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No Strings Attached! No Need to Buy Any Records Ever! Full Advantages of Trial Membership

ALL 10 masterpieces — yours FREE! Performed by world-famous artists. Custom-recorded on purest vinyl. Reproduced with a tonal fidelity encompassing the entire range of human hearing (50 to 15,000 cycles.) This amazing offer is made only to demonstrate superb quality of our recordings, and to show you advantages of trial membership.

HOW CLUB OPERATES—We advise you monthly of new releases. Those you want are sent you for FREE trial. After 5 days' listening—only the records you decide to keep are billed you at the low membership price of \$1.65 per disc (average playing time 40 min.). You save almost 1/2 the usual retail price! This "give-away" offer can obviously not be kept open indefinitely. MAIL COUPON NOW with only 25¢ to help cover cost of postage.

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Symphony No. 26 in E Flat, K. 184

BEETHOVEN

Piano Sonata No. 24 in F Sharp, Opus 78

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The Academic Festival

BERLIOZ

The Neman Carnival

VIVALDI

Concerto in C for Two Trumpets and Orchestra

WAGNER

Die Meistersinger, Prelude, Act 1

BACH

Tocatta and Fugue in D Minor

DUKAS

Sorcerer's Apprentice

MOUSSORGSKY

Night on Bald Mountain

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The Musical Masterpiece Society, Inc., Dept. 47-3
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Enclosed is 25¢ to cover postage for the recordings of 10 masterpieces listed. Enroll me as a trial member. Privileges: No purchase obligation ever! Advance notice of releases. 5 day free trial on any discs. I may reject records before or after receipt; may cancel membership at any time. For future i.p. discs I keep, I'll pay only \$1.65 each plus shipping. Limit: Only one sample package per customer.

Name _____
Address _____
City _____ State _____
Canada, address: 686 Bathurst St., Toronto 6, Ont.

PRECISION AUDIO FROM WWV

By GEORGE BERRY

WWV transmits steady audio tones of 440 and 600 cycles which are useful in checking and calibrating oscillators and other audio gear. The Bureau of Standards carries on 2.5, 5, and 10 mc. send the two audio frequencies alternately in successive 5-minute periods.

If the radio receiver output is run directly to an oscilloscope, it is not always easy to get a good Lissajous figure display on the scope screen unless the signal is good and strong, and free from noise. Furthermore, it is never quite obvious which of the two audio frequencies is being sent at the particular time.

The ultra-simple gadget shown in the diagram will help out in both of these difficulties. It is an audio-frequency tuned circuit. The switch S₁ can tune it either to 440 cycles or to 600. The audio selectivity greatly improves the signal-to-noise ratio of the tone. Moreover, it is possible to tell instantly which of the two frequencies is being received by flipping the switch and noting which setting gives the louder signal.

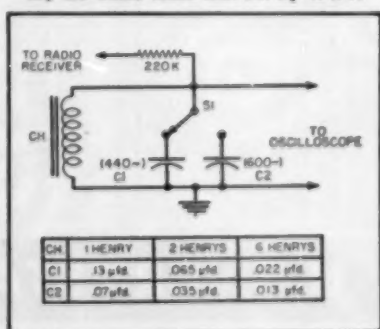
The circuit is fed through a 220,000 ohm resistor to avoid loading down by the receiver output and loss of selectivity. The source can be the headphone jack or the voice coil terminals of the receiver, or the 220,000 ohm resistor can be run to the output tube plate through a .005 µfd. blocking capacitor. A strong signal is helpful.

The tuned circuit choke, CH, can be any of several cheap and plentiful types. Such "a.c.-d.c." radio filter chokes run around 5 or 6 henrys at middle audio frequencies and work well. The primary of a small, inexpensive 35L6 or similar output transformer is usually around 2 henrys and works slightly better. Avoid large or high-quality transformers; they have too much inductance and too low a "Q." Toroidal inductors are best but not worth buying for the purpose. Any surplus toroid between about 0.3 and 3 henrys will give excellent performance, but the tuning capacitance must be adjusted carefully because of the high "Q."

Capacitance values for some common inductance values are shown on the diagram. If the inductance is not exactly known, the right capacitance can be found by trial with an audio oscillator or with the WWV signal itself.

The choke will pick up hum from nearby power transformers if located too close, hence the advantage of several volts of signal to start with.

Handy unit for separating and identifying the audio tones sent out by WWV.



LAFAYETTE'S SPECTACULAR MULTITESTER VALUES



HIGH SENSITIVITY AC-DC MULTITESTER 20,000 ohms per Volt

The new Lafayette High Sensitivity Multitester is a complete instrument (not a kit). Here is an instrument packed with every desirable feature found only in instruments costing twice as much. One of the most sensitive multitesters ever offered. 20,000 ohms per volt DC; 8,000 ohms AC, having a high sensitivity 45 microamps meter. Full scale AC-DC voltage ranges are 0-10V, 0-50V, 0-250V, 0-500V, 0-1,000V; DC current ranges 50 microamps, 2.5 ma, 25 ma, 250 ma. Resistance: 0-5K ohms, 0-50K ohms, 0-500K ohms and 0-5 megohms. Decibel range: -39 to +3 db; ± 5 db (0 db = 0.775V - 600 ohms). Extreme versatility and accuracy. 1% precision resistors; 20" meter; beautiful plastic front, with metal bottom for ruggedness. Size: 3 1/2" x 5 1/4" x 5 3/8". Complete with batteries and leads. Ship. Wt. 4 lbs.

RW-360 NET 19.95
In lots of 3 19.25



SENSITIVE AND ACCURATE AC-DC MULTITESTER 2000 OHMS PER VOLT ON BOTH DC AND AC

An unusual buy in a very accurate and sensitive VOM. Features single selector switch for all ranges. Has 8 "A" sensitive 150 microamp meter, 2000 ohms per volt on both AC and DC. 21 full scale ranges, consisting of AC-DC Voltage Ranges 0-3; 0-15; 0-60; 0-300; 0-1500 Volts; DC Current Ranges: 0-250 μ a; 0-2 MA; 0-200 MA; Resistance Ranges: 0-10 K ohms; 0-1 Meg ohm; Decibels: 0 db \pm 5 db; \pm 30 db; \pm 34 db; \pm 46 db (0 db = 0.774V);

Extreme versatility and accuracy. 1% precision resistors; beautiful plastic front with metal bottom for ruggedness and shielding. Size 3 1/2" x 5 1/4" x 1 1/8". Ship. Wt. 3 lbs.

MODEL RW-308 Complete
In lots of 3 12.45
Singly, ea. 12.95

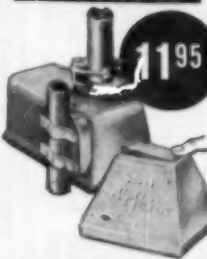
NEW POCKET AC-DC VOM MULTITESTER 1,000 ohms per Volt

This instrument is one of the best buys that Lafayette has ever offered in a Wide Range AC-DC MULTITESTER. An ideal portable unit that meets the need for a compact, yet rugged test instrument. Has ease of operation usually found only in more expensive instruments. Has 1000 ohms/volt sensitivity on both AC or DC. Uses full 3" rectangular meter with large easy to read scale. Uses 1% precision resistors, Jewel D'Arsonval microamp meter movement. Ranges: AC-DC and output volts 0-5, 0-25, 0-250, 0-1000V; DC current 0-1, 0-10, 0-100, MA; Resistance 0-10K and 0-100K ohms. Its handsome sturdy bakelite case. Size: 4 1/4" x 3 1/4" x 1 1/4". Supplied complete with test leads and batteries. A Must for every serviceman, shop, Laboratory or experimenter—and at Lafayette's Price you can afford to own one. Ship. Wt. 2 1/2 lbs.

MODEL RW-37C-Complete In Lots of 3 9.45
Singly, ea. 9.95



NOW!—A ROTATOR AT A BUDGET PRICE ROTOR QUEEN



Here is a rotator that is engineered with outstanding quality features, but without any fancy dood-dad to add to cost. Weather sealed all aluminum housing with maximum mast support—antenna sets 3" into drive unit. Full 370° rotation in each direction with instant braking for pinpoint accuracy. Direct gear drive for high torque—no worm gears. Lifetime oilite bronze side thrust bearing, rustproof parts. Guy wire supports and flagpole type base for easy installation. Control unit of mahogany polystyrene only 3 1/4" x 3 1/4" x 3 1/4". Finger-tip control. Ship. Wt. 7 lbs.

RMS R-55 Rotator Net 11.95

ACCESSORIES

Thrust bearing for above Net 2.91
RMS TB-2
3-wire cable for above per hundred ft. 1.50
WR-49 per ft. .02

COMPENSATOR

for G. E. CARTRIDGE
Designed for use with G.E. reluctance cartridges and preamplifiers. Five settings include LP, AES, Flat, Good 78 and Poor 78. No circuit loss is produced by use of equalizer. A noise when greater bass and treble response is desired. Flat position gives maximum high frequency response. No wiring required—just plug in. With lead and plug. 2 1/4" x 2 1/4" x 3 1/2"—Max. depth 4".
Stock No. PK-61.....NET 4.95



DUAL STYLUS — TRIPLE PLAY

DIAMOND and
SAPPHIRE

LIST \$34.00
Replacement for All G.E.
RFX-616 Triple-Play Cartridges

Stock No. PH-29 Net 11.95

Masco

CASCADIAN
TV BOOSTER

List Price \$42.50

SALE 9.95



Biggest Booster Buy Ever!

Famous Masco Cascade Booster!!

- Three tuned circuits—cascaded!
- Golden Grid 6BE2 Plus 610 Plus rectifier!
- 35 db gain (56 times!) average on all channels!

A sensational new tunable VHF booster utilizing a special low-noise circuit. Employs the new Golden Grid 6BE2 tube as well known for its use in cascade circuits. Field pioneer and specifically designed for new low noise-high gain front ends. Brings superior reception to older type receivers. Single knob control for utmost simplicity of operation. Signal strength is increased at least 56 times—35 db—average on all channels. Rack and pinion permeability for precision stability. Automatically switched on and off by TV set. Uses cross-neutralized 610 and 6BE2 tubes for maximum gain and bandwidth. U/L approved. For 110 volts AC. Wt. 5 lbs.

Masco TVB-53 In lots of 3, Net 9.45 Singly, ea. 9.95

Greatest Tape Buy Ever!

1200 FT. REEL
Genuine Plastic Base
RECORDING TAPE
Ship. Wt. 14 oz.

LAFAYETTE made a terrific deal with one of the leading manufacturers of recording tape to supply us with their regular tape which sells for almost twice our price. WE GUARANTEE ABSOLUTE SATISFACTION OR YOUR MONEY BACK. The finest, professional-quality recording tape obtainable. Highest performance for thousands of playings. Red Oxide Base in a smooth, uniform coating; greater signal strength; with maximum fidelity; uniform frequency response from 40-15,000 cps.

In lots of 10 rolls - 1.75 ea

LAFAYETTE EXCLUSIVE! DYNAMIC EAR PHONE

A new lightweight plastic ear phone especially imported by Lafayette to bring you the high quality of a dynamic ear phone with the ease and comfort of an almost weightless unit—at a price less than half that of any comparable unit. Fits right into ear. Excellent sensitivity of 65 db. Ideal for use with miniature U/L. Ideal for use with miniature U/L. Ideal for use with miniature U/L.

Net 1.95

RCA 807 TUBES

QUANTITY LIMITED
BRAND NEW JAN. SPECS.
STOCK NO.SP-70

1.29

BINOCULARS NEVER BEFORE AT THIS PRICE

IMPORTED DIRECT

- Prism-Coated Lenses
- All-Metal Construction
- Individual Focus
- Leather Case & Straps

F-105, 8 x 30 with case...NET 18.25
F-15, 7 x 35 with case...NET 19.95
F-103, 7 x 50 with case...NET 21.95
F-104, 12 x 50 with case...NET 22.50

with order, Add 10% Fed. Tax

High Output Dynamic Microphone

Worth
Many Times
Its Price



SALE \$14.95 List Price \$47.00

AT LAST! A Hi-Fi Dynamic Mike for Public Address etc. at a price you'd expect to pay for a good crystal mike!

Lafayette went ahead to obtain a high quality DYNAMIC MICROPHONE at a price that is 70% less than any comparable dynamic microphone on the market today. Exceptionally fine for public address, recording and other general purpose use. Substantially flat response, 60-10,000 cps, assures faithful reproduction of speech and music. Impedance 40,000 ohms \pm 15% at 1000 cps. Output Level -55 db. Die cast metal case finished in light gray and fine chromium. Compact and light weight. Net Wt. 1 lb. Head at fixed tilt of 15°, equipped with 6 ft. well shielded low-loss spiral vinyl-jacketed cord. Standard 5/8"-27 thread. Dimensions 1-55/64" high, 3" wide, 5 1/2" deep. Ship. Wt. 2 lbs.

PA-19...Singly, ea. 14.95... In lots of 3 14.45

CROSLLEY UHF FRONT END

- Mallory 3 Gang Inductor
- 6AF4 — 6BE2 and 1N72
- Parts Alone Worth Twice the Price



UHFET front end covers all channels 14 through 62, using the famous Mallory continuous tuning inductor. Original replacement for Crosley part 15409-1-1 used in Crosley series 807 chassis 292 and 294. Ideal for building UHF converters, etc. Output feeds into channel 5 I.F. Converter shaft includes fine tuning. Built-in antenna switch operates off tuning shaft. Comes complete with 1N72 diode, 6BE2 and shock mounted 6AF4 tubes. Size: 8 x 6 x 3 1/2". Ship. Wt. 5 lbs. Quantity limited.

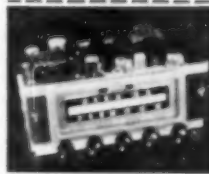
TL-25.....Lots of 3, ea. 4.45

Singly, ea. 4.95

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CUSTOM RADIO CHASSIS—CHANGERS—HI-FI SPEAKERS

17" TO 27" TELEVISION CABINETS—LESS THAN FACTORY COST!



JACKSON AM9A

9-TUBE HI-FIDELITY

12 Watts Audio \$39.95
Dual Tone Controls

RECEIVES BROADCAST 550 TO 1650 K.G.

Jackson Model AM9A, 12 watts high fidelity audio amplifier and broadcast tuner combined, at less than you would normally pay for the amplifier alone. Push-pull 6V6 output. Frequency response from 30 to 15,000 cps. Inputs for crystal or G.E. variable reluctance pickup and crystal or dynamic microphone. Separate bass boost and treble tone controls. Radiophone switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 150 mil power transformer. 2 1/2" illuminated slide rule dial with etched glass scale. 3 gang condenser with tuned P.P. stage and tone antenna. Receiver broadcast 550 to 1650 kc. Size 13" long, 6" high and 9 1/2" deep. Complete with tubes: 3-6BA6, 6AU6, 6BE6, 6BN7, 6AT6, 2-6V6 and 5Y3. Knobs, escutcheon, diagram and instructions included. Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 9 lbs. Sale price, \$39.95. Model AM9A with our CU-14V 12" coaxial PM speaker, both for \$49.95. Model AM9A with our P15-CR 15" coaxial PM speaker, both for \$59.95.

11-TUBE FM-AM HALLICRAFTERS

Regular \$89.50 \$69.95
McGEE'S SALE PRICE

HIGH FIDELITY
★ AUTOMATIC FREQUENCY CONTROL



HALLICRAFTERS S-78A

with push-pull 6X6 audio. This chassis found in 5400 to 5600 radio combinations. Has input for crystal phono pickup. Self-powered preamplifier necessary for G.E. variable reluctance cartridge. \$3.95 extra.

S-78A Hallicrafters 11 tube FM-AM chassis. Ship. wt. 22 lbs. \$69.95. S-78A Hallicrafters with our CU-14V 12" coaxial PM speaker \$79.95. S-78A Hallicrafters with our P15-CR 15" coaxial PM speaker \$89.95.

GARRARD—COLLARO—WECOR

3-SPEED RECORD CHANGERS

\$65.00 LIST COLLARO 3/532 \$38.95

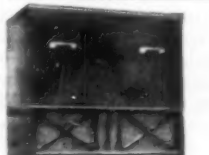
Here are top values in modern up-to-date 3 speed automatic record changers. New WECOR Model 114-45, 3 speed automatic changer with RPX-650 G.E. cartridge. Size 13 1/2" x 12". Ship. wt. 12 lbs. Sale price only \$29.95.

Regular \$65.00 list Collaro model 3/532, 3 speed automatic record changer made in England. Internals 10 and 12" records at same speed. Constant speed 4 pole motor and weighted turntable with matted rubber pulley. Compensating spring to shift weight of tone arm for LP and 45 records. Plug-in head will hold any popular cartridge. 14 1/2" long, 13 1/2" wide and 4 1/2" above motor board. 2 1/2" below. Available in green, grey, cream and gold hamper tone. Ship. wt. 20 lbs. Regular net. \$49.75. Special sale price, \$38.95 less cartridge. \$3.95 extra. 3/532 Collaro changer with G.E. Golden Treasure RPX-652 cartridge, \$58.95. NC-60 Garrard "Triumph", 3 speed automatic changer, 13 1/2" wide, 15 1/2" deep and 2 1/2" high. 2 1/2" below motor board. Net price, less cartridge, \$48.95. 45 RPM spindle \$3.43 extra. NC-60 with G.E. RPX-652 Golden Treasure cartridge, Net \$48.51. MC-60 Garrard "Crown", 3 speed automatic changer, 13 1/2" x 15 1/2" x 2 1/2" above motor board and 2 1/2" below. Net price, less cartridge, \$68.15. With crystal flip-over cartridge, \$72.00. With G.E. RPX-652 Golden Treasure, \$89.13. 45 RPM spindle, \$3.43 extra.



21" BLOND TV-RADIO-PHONO CABINET—SALE PRICE \$49.95

Blond mahogany combination TV-Radio-Phono cabinet. Has full doors with panel cut for 20" or 21" TV chassis. Has space for radio chassis, record changer and record storage. Beautiful blonde finish with matching grill cloth and gold color hardware. TV compartment is 21" high, 13 1/2" wide and 19" deep. Will hold most 20" and 21" chassis. Changer shelf 15 x 16 with 9" height clearance. Ship. wt. 75 lbs. Sale price, only \$49.95. 21" gold trim plastic safety shield and mesh to fit cabinet, \$6.95 extra. No. A13-9, ball bearing changer drawer slides, \$1.39 pr. extra.



RT-21MA \$49.95

DRY-21M \$59.95

KL-27X \$39.95

21" Mahogany Television-Phono Cabinet

RT-21MA, Mahogany Television-Phono combination cabinet with half doors, for 20" and 21" TV chassis and record changer. 36 1/2" high, 39 1/2" wide and 22" deep. Baffle cut for 12" speaker. TV compartment 21 1/2" high, 23 1/2" wide and 19" deep. Will hold most 20" and 21" chassis. Changer shelf 15 x 16 with 9" height clearance. Ship. wt. 75 lbs. Sale price, only \$49.95. 21" gold trim plastic safety shield and mesh to fit cabinet, \$6.95 extra. No. A13-9, ball bearing changer drawer slides, \$1.39 pr. extra.

DeLuxe 21" Mahogany TV-Phono Cabinet

DRY-21M, DeLuxe flame grain mahogany Television-Phono combination cabinet for 20" and 21" TV chassis and record changer. Beautiful full door style with matching front panels and plane finish. 37" high, 40 1/2" wide and 22 1/2" deep. Baffle cut for 12" speaker. TV compartment 21 1/2" high, 23 1/2" wide and 19" deep. Will hold most 20" and 21" TV chassis. Changer shelf 15 x 17 with 9" height clearance. Ship. wt. 90 lbs. Since No. DRY-21M, Sale price only \$59.95. 21" mesh and safety glass available at \$6.95 extra. (Requires fitting to cabinet) No. A13-9, ball bearing changer drawer slides, \$1.39 pr.

24"-27" Mahogany TV Cabinet \$39.95

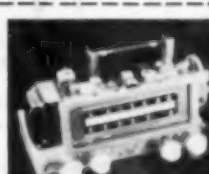
Large mahogany open face cabinet for 27" or 24" television chassis. 44" high, 30 1/2" wide and 24 1/2" deep. Will hold a TV chassis 20" high, 29" wide and 22 1/2" deep. Offered at a fraction of the manufacturer's cost. Limited quantity available. Has room for 8" or 10" speaker. This cabinet and other TV cabinets listed might also be converted to a high fidelity speaker baffle. Stock No. KL-27X. Ship. wt. 90 lbs. Sale price \$39.95. Blank front panel available at \$5.00 extra.

McGEE RADIO COMPANY

F.O.B. KANSAS CITY
SEND \$2.00 FOR FULL
REMITTANCE WITH ORDER.
BAL. SENT C.O.D.

OUR NEW ADDRESS IS

1901 McGEE ST., KANSAS CITY, MISSOURI



HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER

BOTH FOR \$49.95

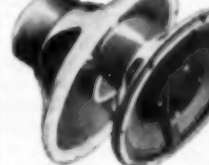
9 TUBES-PLUS
2 RECTIFIERS
PHONO INPUT

10 W. AMP.

New, high fidelity self-powered FM-AM tuner with 10 watt amplifier (Push-pull 6V6's) on separate chassis. All you need is a record changer and one of the speakers shown below to have a complete home music system. 3 ft. cable connects tuner to amplifier. Tuner has input for crystal phono pickup. (It one of the changers with a G.E. variable reluctance cartridge is purchased, we will include the necessary pre-amp at no extra charge). Self-powered tuner has 6 tubes plus rectifier 13AT7, 6BE6, 2-6BA6, 6AT6, 6AL5 and 6X4. Amplifier has 3 tubes: 2-6V6's, 6BN7, plus rectifier. Full superhet circuit with AVC and 3 position tone control. 2" illuminated slide rule dial with gold color escutcheon and matching knobs. Has "High-Q" ferrite stick loop antenna for AM and separate FM antenna. Radio FM, AM, phono selector switch, tone control, volume control-off-on switch, are the tuner chassis. High fidelity response, 50 to 17,500 cps. Receives broadcast 540 to 1600 kc and FM 88 to 108 mc. Output transformer will match any of the speakers listed below. This high fidelity FM-AM tuner and 10 watt amplifier is comparable with competitive units selling for \$100.00 and more. Stock No. PAB-2CR, tuner and amplifier complete with all tubes, knobs, instructions and diagram. Ship. wt. 23 lbs. Special sale price, only \$49.95. CU-14V, 12" coaxial PM speaker, \$12.95 extra. P15-CR, 15" coaxial PM speaker, \$20.00 extra, when ordered with turntable. Collaro 3/532, 3 speed automatic internal mixer with crystal flip-over cartridge, \$42.00 extra.

McGee's Famous

12 AND 15 INCH COAXIAL P.M.
HIGH FIDELITY SPEAKERS



12-inch
Model CU-14V

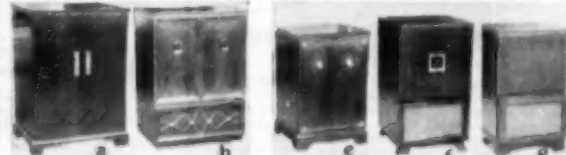
15-inch
Model P15-CR

Model CU-14V, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 6.6 ohm Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a quality speaker. Stock No. CU-14V. Sale price \$12.95 each, two for \$25.00. Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 20 cps. and up to 17,500 cps. Full 2 1/2" x 6" Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 8" high frequency tweeter. Built-in crossover network. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular \$62.50 list speaker. Model P15-CR, McGee's Sale Price, \$23.95.

HIGH FIDELITY SPEAKERS

8" BLUE STREAK \$ 6.95
12" JENSEN P-12P \$15.95
15" WOOFER \$18.95

Model MF-8, 8" "Blue Streak" High Fidelity wide range speaker. This one speaker properly balanced will give excellent response to both high and low frequencies and berrie response through the very important middle range. It has tone quality equal to many high priced imported speakers. Has 6.6 ohm Alnico V magnet with wide range curvilinear cone and 8 ohm voice coil. This speaker has a beautiful tone at low volume levels. 8 watts continuous with peaks up to 12 watts. Response essentially flat from 36 to 13,500 cps. Ideal for use with a woofer for a high fidelity speaker system. Perfect for high fidelity radio, amplifiers and professional music systems. Ship. wt. 6 lbs. Model MF-8J. Sale price, \$6.95. Model P-12P, 12" Jensen Concert High Fidelity wide range speaker. Was 14 1/2" of Alnico V magnet with 1 1/2" x 6" ohm voice coil. Heavy ribbed, easy moving midrange cone. Will take 18 to 28 watts of audio. Ideal for P.A. systems as well as music speaker for a high fidelity speaker system. Frequency response 30 to 12,500 cps. Model P-12P, 12" Jensen Concert PM speaker, Ship. wt. 8 lbs. Sale price \$15.95. Model SP-15P, 15" "Blue Streak" High Fidelity wide range speaker. Was 14 1/2" of Alnico V magnet with 1 1/2" x 6" ohm voice coil. Heavy ribbed, easy moving midrange cone. Will take 18 to 28 watts of audio. Ideal for P.A. systems as well as music speaker for a high fidelity speaker system. Frequency response 30 to 12,500 cps. Model SP-15P, 15" Jensen Concert PM speaker, Ship. wt. 10 lbs. Sale price \$18.95. This is an ideal woofer for a high fidelity speaker system. Use a cross-over network for best results. Has 2 1/2" of Alnico V magnet, with 1 1/2" x 6" ohm voice coil. Has free flex cone for easy construction. Will respond to frequencies down to 20 cps. and up to 10,000 cps. Takes 18 watts with peaks up to 28 watts. This speaker used with the 8" Blue Streak and 15" Blue Streak speakers described above makes a top quality high fidelity speaker system. Model SP-15P, 15" "Blue Streak" woofer speaker, Ship. wt. 12 lbs. Sale price, \$18.95.



TELEVISION CONSOLE CABINETS AT LESS THAN FACTORY COST!

FOR YOUR TV CHASSIS—MODELS FOR 27-INCH TO 16-INCH CHASSIS

27" Mahogany Full Door Cab. \$59.95
(a) No. 17-MA Mahogany with full doors for 21", 24" and 27" TV. 43" high, 31 1/2" wide and 22 1/2" deep. Chassis area 27 1/2" x 25" h. 18 1/2" deep. Baffle for 10" speaker. A beautiful cabinet made by the factory over \$100. Made for a \$60 TV set. Ship. wt. 90 lbs. Sale price \$59.95. Blank panel \$5.00 extra.
(b) No. 17-MA Mahogany with full doors for 21", 24" and 27" TV. 43" high, 31 1/2" wide and 22 1/2" deep. Chassis area 27 1/2" x 25" h. 18 1/2" deep. Baffle for 10" speaker. A beautiful cabinet made by the factory over \$100. Made for a \$60 TV set. Ship. wt. 90 lbs. Sale price \$59.95. Blank panel \$5.00 extra.
(c) No. 17-MA Mahogany with full doors for 21", 24" and 27" TV. 43" high, 31 1/2" wide and 22 1/2" deep. Chassis area 27 1/2" x 25" h. 18 1/2" deep. Baffle for 10" speaker. A beautiful cabinet made by the factory over \$100. Made for a \$60 TV set. Ship. wt. 90 lbs. Sale price \$59.95. Blank panel \$5.00 extra.
(d) No. 17-MA Mahogany with full doors for 21", 24" and 27" TV. 43" high, 31 1/2" wide and 22 1/2" deep. Chassis area 27 1/2" x 25" h. 18 1/2" deep. Baffle for 10" speaker. A beautiful cabinet made by the factory over \$100. Made for a \$60 TV set. Ship. wt. 90 lbs. Sale price \$59.95. Blank panel \$5.00 extra.
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(l) No. 17-MA Mahogany with full doors for 21", 24" and 27" TV. 43" high, 31 1/2" wide and 22 1/2" deep. Chassis area 27 1/2" x 25" h. 18 1/2" deep. Baffle for 10" speaker. A beautiful cabinet made by the factory over \$100. Made for a \$60 TV set. Ship. wt. 90 lbs. Sale price \$59.95. Blank panel \$5.00 extra.
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TV SETS & TAPE RECORDERS
FASTER, EASIER, MORE PROFITABLY
WITH THESE NEW RIDER BOOKS!**

PICTURE BOOK OF TV TROUBLES
by the Rider Laboratory Staff
JUST PUBLISHED: VOLUME 2
(Vertical Sweep-Deflection Circuits)

Here's the only book ever devoted exclusively to vertical sweep circuits! Rider's expert lab staff tells you about forty-six different kinds of vertical sweep circuit troubles... all based on actual troubleshooting done right in the Rider lab! To describe these troubles, they show you 96 "faulty" picture tube pattern illustrations—and right next to each one, you see the "abnormal" waveforms they get while checking key points... the same waveforms you'd see on your scope screen if you'd done the checking! And here's a very special feature: the last 5 pages in the book form a handy pull-out section that shows you exactly what the RIGHT waveforms should look like! It takes just seconds to compare any "abnormal" waveform in the book with its "normal" version shown in this pull-out! There's no theory—no "maybes"—this book tells and shows you how to diagnose TV receiver troubles by picture and waveform observation... how to do that servicing job better, faster, easier!

CHAPTERS: Blocking Oscillator Vertical Sweep Circuits—Multivibrator Vertical Sweep Circuits—Vertical Output Transformer Replacement—Vertical Retrace Blanking and Deflection Yoke Circuits—Rapid Trouble-shooting of Vertical Sweep System.

Cat. #168-2, 8 1/2" x 8 1/2", paper bound only \$1.80
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**RIDER'S SPECIALIZED TAPE
RECORDER MANUAL, VOL. 1**

Servicing tape recorders is BIG business—and here's your opportunity to get your share of this profitable market! With this fact-filled 288-page manual, you'll be able to service every recorder put out by the 12 most prominent manufacturers during the 5 years from 1950 through 1954! Includes everything you need to know about operation, adjustments, trouble diagnosis, and repair of 88 different models! Here's the kind of servicing information you get on each model: amplifier schematics; voltage data; tube complement & layout; exploded views of mechanical assembly; troubleshooting charts (with instructions on electrical and mechanical organization); how to use tape recorders with other devices; electrical and mechanical parts lists.

COVERS ALL THE MOST PROMINENT BRANDS: Bell & Howell (Stereotone)—Brush Development (Soundmirror)—Columbia Rec. (Columbia-Bell & Howell)—Crescent Ind. (Steno)—Daystrom (Crestwood)—Elicor, Inc. (Elicor)—Pentron Corp. (Pentron)—Radio Corp. of Amer. (RCA)—Revere (Revere)—Three Dimension Co. (Stereotone)—V-M Corp. (Tape-O-Matic)—Webster-Chicago (Webcor)—Webster Elec. (Ekotape)—Wilson-Gay (Recordite).

Cat. #6001 288 (8 1/2" x 11") pp., paper bound only \$4.50

HOW TO INSTALL TV ANTENNAS
by Samuel L. Marshall

This book lives up to its title! It's completely practical—an illustrated "Antenna Bible" you'll refer to every time an installation job comes in! Tells you everything you need to know about installing TV antennas: safety precautions; putting up masts and towers; getting the best reception in fringe areas; wind and icing problems; types of antennas, and when to use them; rigging, roofing, and masonry work; in short—how to do the job RIGHT... quickly, safely, economically!

CHAPTERS: Antenna Fundamentals—VHF Antennas—Transmission Lines & Stubs—UHF Antennas—Installation Materials & Methods—High Masts & Towers—Installation Problems.

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☐ SPECIALIZED TAPE RECORDER MANUAL \$4.50

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TV SERVICE HINTS

ACTUAL servicing case histories are invaluable to the service technician. Many technicians keep a notebook in which they record the more unusual and difficult service jobs they handle. This serves as a guide, available for quick reference when they come up against a similar problem. Given below are some of the case histories recorded by one practicing service technician.

Raster Troubles

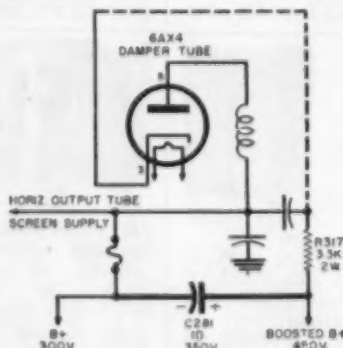
CBS-Columbia Model 22C09

Drive bar elimination—If difficulty is experienced in eliminating a drive bar by variation of the horizontal drive control, C_{50} , reduce the value of the coupling capacitor C_{47} (470 μ fd.) by inserting another 470 μ fd. ceramic capacitor in series with it. Check all channels for possible parasitic oscillation whenever a series or parallel capacitor combination is used. If parasitic oscillations result, replace both capacitors with a single 240 μ fd. ceramic capacitor.

Du Mont RA 167 Chassis

Intermittently shrinking raster—This set displayed the intermittent symptom of a shrinking raster, particularly noticeable in the vertical dimension. A decrease in brilliance of the picture was noted concurrently with the raster shrinkage. Contrast of the picture remained approximately normal considering the change in the brightness. Analysis of the symptoms indicated that something was affecting the high voltage and the sweep sections—mostly the latter.

A monitor voltmeter was placed on the 300-volt low-voltage supply bus and another monitor with the high-voltage probe was used to check high voltage at the second anode. There



was practically no change on the low-voltage 300-volt bus when the intermittent occurred—only a slight increase of about 5 volts was observed. The high-voltage monitor voltmeter revealed a drop of 750 volts at the time of the intermittent.

The monitor was moved to the boosted "B+" for the next trial. When the intermittent occurred again, the

boosted "B+" lost 50 volts from its normal 450 volts. Ohmmeter checks of the boosted "B+" circuit failed to reveal any pertinent deviations from rated values of the components. Replacement of the electrolytic capacitor, C_{50} , between the "B+" 300-volt line and the boosted "B+" bus, as shown in the accompanying diagram, eliminated the trouble. (The continuity between the cathode of the damper tube through the flyback, linearity coil, etc., is shown by the dotted line in the drawing for the reader's convenience in analyzing this trouble.)

Inasmuch as the vertical sweep and vertical output are fed by the boosted "B+" bus, the vertical shrinkage was more prominent in the displayed symptom. Contrast was not appreciably affected since it is not fed by the "B+" boost, but from the lower voltages.

General Electric Model 17T20

Intermittent jitter of raster width—This trouble was traced to corroded contacts on the yoke interlock terminals 10 and 11, which were cleaned. The interlock is in the "B+", 275-volt circuit to the screen grid of V_{50} , the 6BQ6GT horizontal output tube. Naturally, a small drop in the screen voltage would shrink the raster and, if the voltage returned to normal fast enough, would not appreciably affect the set so as to produce other symptoms characteristic of a lowered horizontal-output screen voltage.

Sylvania Chassis 1-504-2

No raster but adequate high voltage—This set will display this symptom whenever the coupling capacitor from the video output tube to the CRT cathode leaks excessively or completely short circuits. The coupling capacitor in question is C_{50} having a value of .22 μ fd. Leakage will permit "B+" to bias the CRT cathode more positively than the normal positive voltage supplied by the picture brightness control thus, in effect, making the grid bias more negative. If this bias is large enough, it will cut off the CRT beam.

Travler Chassis 46A3

Excessive width—If the width is excessive, the high voltage filter capacitor (C_{50} , 500 μ fd., 20 kv.) return may be made to terminal 8 of the flyback transformer instead of its normal connection to chassis. This will yield a slightly greater high voltage, improved punch to the picture, and decreased width. The focus may require a slight re-adjustment due to the increased high voltage.

Picture Troubles

Du Mont RA 109-112 Series Chassis

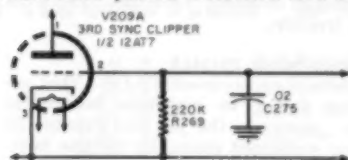
Short-circuited coupling capacitor in picture i.f. transformers—Some of the pix i.f. transformers in these sets used

a coupling capacitor between primary and secondary windings for variation of the coupling capacity during alignment operations. The base of the "Z cans" (as they were dubbed at the factory) or I.f. transformers were fabricated of a thermoplastic compound which permitted the terminals and other parts attached to the base to move when heated. This could occur whenever wires are soldered to the connecting terminals of the transformer. The coupling capacitor could thus move and contact the winding of opposite polarity (with respect to "B+") and create a short.

Repair may usually be made by removing the can cover, gently warming the base with heat from a nearby soldering iron, and bending the capacitor away from the winding with which it will be found in contact in these cases. A wedge of paper may be inserted between the winding and the capacitor to keep the two separated while the base cools. Use caution in resoldering into the circuit and in unsoldering for repair and/or inspection, as the parts may move again.

Du Mont RA 166 Chassis

Critical vertical hold—This set displayed critical vertical hold. The horizontal hold seemed to be more critical than it should have been although this would have passed unnoticed had not



attention been directed to the sync by the major symptom of very critical vertical hold. These facts led to the theory that the composite sync was affected. Oscilloscope checking revealed loss of sync at the third sync clipper, V_{ma} , which is half of a 12AT7 dual triode. Ohmmeter testing revealed that the grid resistor of this tube had changed from the rated value of 220,000 ohms to 1.8 megohm. This resistor is R_{m} . Replacement cured the trouble.

Motorola Model 21F3

4.5 megacycle harmonic interference—If such interference is relatively weak in this combination set, the 1000 μ fd. capacitor C_m , at the output of the 6AL5 ratio detector, V_a , may be increased in value to 5000 μ fd. without serious loss of the high notes in sound reproduction. If the customer is a high-fidelity enthusiast, a filter may be used instead of the summary change of the capacitor. To do this, break the lead between R_m (33,000 ohms) and C_m (5000 μ fd.) and insert a 47,000 ohm resistor. One end of this inserted resistor will be bypassed by C_m ; bypass the other end with another mica or ceramic capacitor of 1000 μ fd., equal to C_m , thus forming a pi filter. Far less attenuation of the high frequencies results, plus a severe attenuation of the undesired 4.5 mc. harmonics.

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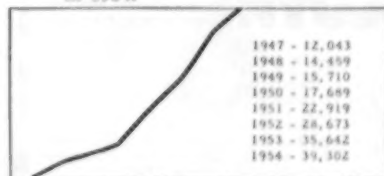
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detection and amplification. Measurement at the output of the picture detector, across C_{m1} , revealed one-fifth normal voltage in contrast to the input to the video detector. Replacement of the 1N60 crystal detector eliminated the difficulty.

The crystal detector acted satisfactorily as a mixer for the sound section i.f. which is taken off at the junction of L_{m1} and C_{m1} following the detector. The crystal did not act as a satisfactory AM rectifier however, and for this reason the picture was weak.

High Voltage Troubles

Admiral Model TA2216A

Corona streaks—This trouble was noticed when high humidity was present as on a day following a prolonged rain. The defect was traced to points on the resistor R_{m1} , 4.7-ohms, in the filament circuit of V_{m1} , the 1B3 high-voltage rectifier. Running a blob of solder on the points after cutting them as close as possible, eliminated the corona and also the streaks in the picture caused by it. Resistor R_{m1} is mounted on the lugs of socket terminals 2 and 6 of the high voltage rectifier.

CBS Columbia Model 17M18

Horizontal flashing at high brilliance—Cause was an excessive value of the resistor in the second anode lead to the picture tube. This resistor easily overheats due to the stresses on it and increases in value under operation. An ohmmeter check may not tell what the value of this resistor is in actual operation. A high voltage check will tell the story if the symptom is sufficiently pronounced. The best course of action is the replacement of the resistor whenever this condition arises. The resistor should be replaced with one of about 680,000 ohms, a conventional size in high voltage resistors which is the only type to use for this duty.

Du Mont RA 109 Chassis

Short and leakage of damper heater transformer—Several manufacturers supplied Du Mont with the transformer T_{m1} used as a separate damper heater supply. Some of these transformers had very poor finish of the outer casing at the openings for the heater wires. While factory corrected, some of the transformers are out in the field and cause trouble due either to a direct short or leakage from a partial short.

Since the damper heater supply is connected to terminal 2 of the flyback transformer, T_{m1} , the boosted "B+" is either totally or partially shorted to the chassis whenever a short or leak occurs in the damper heater transformer. Consequently, if lowered boosted "B+" is encountered or the boosted "B+" is absent, the damper heater transformer should be inspected with a magnifying glass at the points of emergence of the heater wires. A soldering pick or an awl may be used to pry the case away from contact with

RADIO & TELEVISION NEWS

the "hot" wires as a repair in the majority of instances.

Du Mont RA 167 Chassis

Ringings—vertical bars on the left-hand side—This occurred when capacitor C_{201} , 47 μ fd., between terminals 2 and 3 of the horizontal deflection coils (not deflection yoke plug terminals) lost capacity and measured approximately 18 μ fd. Replacement with a ceramic 47 μ fd. unit still permitted some ringing with the accompanying symptom of bars. The capacitor was then increased to 56 μ fd. and this eliminated the symptom.

The anti-ring capacitors in the horizontal part of the yoke are critical and even the prescribed replacement may have to be varied in some instances.

Sylvania Model 172MU, Chassis 1-508

Vertical dotted lines on left side of picture—The lines may be differentiated from overdrive lines in that they are not solid but are comprised of short dots slightly elongated. This is caused by relatively poor filtration of the high voltage after leaving the vicinity of the high-voltage rectifier. This internally generated TVI is picked up by the antenna lead.

To cure this trouble, dress the antenna lead away from the high-voltage second anode lead as far as possible. Also, install a 30,000 ohm, 2-watt resistor (up to 47,000 ohms is OK) at the junction of the second anode lead and socket terminal 7 of V_{201} , one of the two high-voltage rectifiers. If this resistor insertion is not sufficient, add a 500 μ fd., 20 kv. cartwheel capacitor from socket terminal 7 of V_{201} to ground. Use only a good grade resistor for the inserted filter resistance to prevent corona and subsequent internal breakdown.

General Troubles

Admiral Chassis 20A2

Poor sensitivity on weak stations—This trouble developed after about six months of service and was traced to a lowered value of resistance of R_{101} which should be 1500 ohms but actually measured about 450 ohms. This resistor is in the plate return circuit of the 6BZ7 (V_{101}) r.f. amplifier in the tuner. The resistor was smoked due to an overload so the 6BZ7 was changed also. The 6BZ7 developed excessive current after about an hour of operation in a tube tester but did not show a short. Replacement of resistor and tube cured the complaint.

Hoffman Model 21M903

Parasitic oscillation of audio output—The sound contained a hiss and some interference was present on all channels whenever a reasonably large audio output was obtained by turning up the volume control. Naturally this gave the clue that the trouble was in the audio stages and was an oscillation, since shorting the first I.f. grid removed the pic symptoms.

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Magnavox Series 300 Chassis

Hum in audio—Hum in one of these sets using the audio amplifier model 135 was eliminated successfully by doing two things. First, the audio leads from the TV-phono switch in the television chassis were dressed away from the filter choke and close to the chassis pan. Then, a new 6T8 ratio detector, first audio tube (V_{im}) was inserted in the TV chassis.

If further hum reduction is desired, it may be obtained by adding a 47,000-ohm resistor in series with the load resistor of the 6T8 tube. The load resistor which is already in the circuit will be found at pin 9 of the 6T8. Be sure to bypass the added resistor to ground with a .22 μ fd., 400-volt capacitor, added at the junction of the original load resistor and the 47,000-ohm added unit.

Of course, the first thing to try for hum reduction is to reverse the amplifier a.c. plug in the power line outlet.

—30—

Simplified Color TV

(Continued from page 39)

static systems that for the dynamic or a.c. convergence action a parabolic waveshape is necessary to compensate for the sweep of the electron beam over a surface which is not a perfect arc. Consequently, the magnetic a.c. field must be parabolic and therefore, the current through each coil must be parabolic.

The dynamic convergence circuit in the new RCA color set uses no tubes and is adaptable to other magnetically-

converged color picture tubes. Fig. 8 shows the entire convergence circuit and it will be apparent that there are actually three separate, individually-adjustable networks. At the left is the cathode of the vertical output amplifier. By means of the capacitive network, C_1 , C_2 , and C_3 , a parabolic current is obtained. This current is applied through three potentiometers, the vertical tilt controls, to each of the convergence coils. The series potentiometers determine the amplitude of this current. In order to keep the horizontal signal out of the vertical section a 400 millihenry choke is inserted in each lead. Since the convergence coils are relatively low in inductance for the 60 cycle vertical signal, they represent mostly a resistance and the parabolic voltage applied will produce a parabolic current and magnetic field.

The horizontal signal is obtained from a special winding on the flyback transformer and is originally a pulse voltage. This voltage results in a sawtooth current through coil L_1 and a parabolic voltage is developed across C_{10} . The amplitude of this voltage is determined by the potentiometer in each convergence coil assembly. By autotransformer action, the signal applied to the centertap is induced into the entire coil assembly which, together with the 400 millihenry choke, forms a series resonant circuit at the horizontal frequency. The result is a parabolic current at 15 kc. flowing through the convergence coils. The trimmer capacitor across each coil varies the resonant frequency slightly and thereby changes the phase of the parabola in each coil.

Although further modifications in the convergence system will undoubtedly be introduced in the future, the circuit shown in Fig. 8 is already a great improvement over previous RCA circuits in that it requires no tubes and permits adjustment of each individual electron beam as to d.c., vertical, and horizontal convergence. By making these adjustments independent of each other, the over-all set-up, installation, and alignment of color TV receivers has been greatly simplified.

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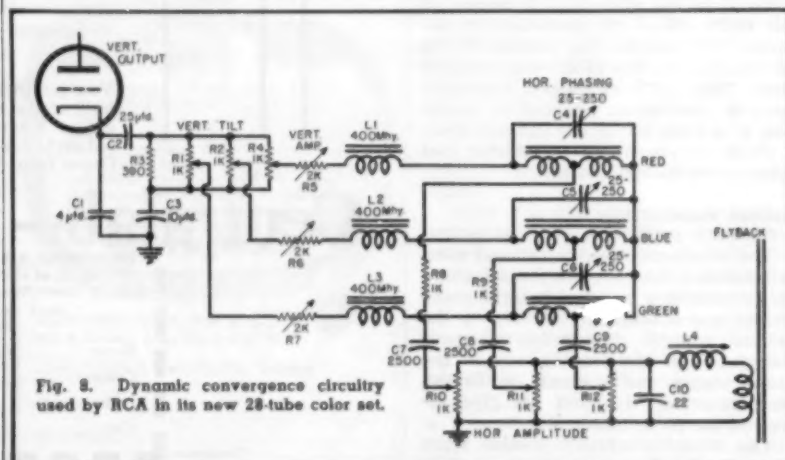


Fig. 8. Dynamic convergence circuitry used by RCA in its new 28-tube color set.

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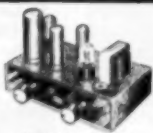
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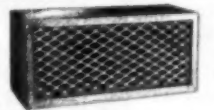
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Every foot absolutely perfect. Includes solid and stranded types—cotton, rubber or plastic insulated. 200 Volt, 75% C Hi-tensile wire. Most fantastic deal ever offered. Kit of 3-shpg. wt. 2 lbs.

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Asstic high output crystal mikes for PA systems and recorders. Equipped with hand-lens and V shielded cable. Shpg. wt. **\$5.95**

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GIANT TV ANTENNA KIT

Stock No. AU-24
REG. \$31.95 **\$12.99**
Complete kit—nothing more to buy. For best reception, use all VHF channels. Rust-proof Aluminum. Contains: 2 six-element conical bars, 1 pair of bars, 2 five ft. 1 1/2" mast sections, 1 ohm lead-in, 3 standoff insulators, 2 screw-eye standoffs, 1 mounting base, 1 guy ring, 1 clamp set, 1 pipe clamp, 1 set of 1/2" x 1/4" bolts. Save—order 12 sets—only \$119.50. Shpg. wt. each 13 lbs. Express only.

Nationally Advertised Tester—SUPER METER
Combination Volt-Ohm-Milliammeter PLUS capacity, Reactance, Inductance & Decibels Complete with Instructions and Test Leads. Measures capacity and electrostatic capacitance. Look at all these Ranges—DC VOLTS: 0 to 7.5/75/150/750/1500. AC VOLTS: 0 to 15/150/1500. CAPACITY: 0.001 to .01 MFD 1 to 10 MFD. REACTANCE: 150 to 25,000 ohms 15,000 ohms to 2 meg. INDUCTANCE: .01 to 100 mH. Decibels: 55 to 7000. HERTZ: 150 to 100,000. A.C. 100,000 ohms 100,000 to 10 meg. DISTORTION: -10 to +18 db. +10 to +38 db. +30 to +58 db. Round cornered molded case. Beautifully finished. Plastic case beautiful mottled brown. Shpg. wt. 4 lbs.

STOCK NO. **\$16.95**
These Ranges—DC VOLTS: 0 to 7.5/75/150/750/1500. AC VOLTS: 0 to 15/150/1500. CAPACITY: 0.001 to .01 MFD 1 to 10 MFD. REACTANCE: 150 to 25,000 ohms 15,000 ohms to 2 meg. INDUCTANCE: .01 to 100 mH. Decibels: 55 to 7000. HERTZ: 150 to 100,000. A.C. 100,000 ohms 100,000 to 10 meg. DISTORTION: -10 to +18 db. +10 to +38 db. +30 to +58 db. Round cornered molded case. Beautifully finished. Plastic case beautiful mottled brown. Shpg. wt. 4 lbs.

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STOCK NO. **\$4.99**
X-419. 5A.
We guarantee these meters to be the best value in precision instruments we have ever offered. Every one 100% guaranteed. Size 5 1/2" x 4 1/2" x 1 1/2". Mounts on surface of panel. No big holes to drill. Equipped with zero adjustment on front scale. Genuine "Arrows" movement. Plastic case beautiful mottled brown. Shpg. wt. 3 lbs.

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Contains 10 Popular Video Transformers. Round IF Transformers. Video IF Transformers. Some are dual. Equipped with iron tinning slugs. Genuine RCA end Dumont. Brand New. Value \$8.50. Shpg. wt. 2 lbs.

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"Beam" TV antenna in the best direction for strongest signal within range. Life-time lubricated rotor encased in water-tight case. Takes antenna masts up to 1 1/2" dia., 115 volts AC—30 watts. Rotates 360° at 2 RPM.

Standard Model K-22 **\$18.71**
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Deluxe Model T-10 **\$22.50**
Stock No. AU-12

Finger tip operation; lights on when rotation limit reached. Control box & rotor—shpg. wt. 12 lbs.

Control bar on top—with direction pointer. Control box & rotor—shpg. wt. 12 lbs.

4-Conductor Cable **\$2.95**
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100 ft. only...
For all Types Rotors, Shpg. wt. 3 lbs.

Thrust Bearing for Heavy Antennas, Shpg. wt. 3 lbs. **\$2.91**
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STOCK NO. W-80 **\$2.98**

Price Slashed! New pencil type. Genuine Western Electric. Dynamic unit is internally coupled to a UTC output High Impedance Transformer. Matches any amplifier which is designed for crystal, dynamic or ribbon mikes. 1 1/2" dia. Hand screws and is removable so mike can be hand held. Shpg. wt. 2 lbs.

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1200 Ft. Tape on 7" Dia. Reel
STOCK NO. X-349. Lots of 12.
Famous Brand—Reg. \$5.50—Now at 71¢ discount. Frees up 50-15,000 cycles per inch—fits all recorders. Shpg. wt. (one dozen) 10 lbs.

Olson Special 232 Resistors Bargain Kit

STOCK NO. **\$3.95**
AS-84.

Value packed with 200 1/2-watt, 20-1 and 2 watt; and 12 -5 to 25 watt wire-wound resistors worth over \$23.50. 5-10-20% tolerances. Includes 100% Olson Guaranteed. Shpg. wt. 2 lbs.

"Powerfone" Cradle-Phone

Self-powered with Built-in Buzzers
STOCK NO. X-448 **\$5.95**
SET

Complete two phone system. Works up to one mile. Durable, dependable. Lifetime electro-magnetophone. Gold-plated diaphragm carbon mikes. Connects in 2 seconds—place on table or mount on wall. Complete—you get 2 telephones with built-in buzzers, 2 cradles, 2 batteries, 5 ft. double cable. Handsome Gift Carton. Money-back Guarantee if not as good as you expected! Shpg. wt. 4 lbs.

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6 complete sets, each...\$4.50
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with 4 E-Z Swivel Casters
BARGAIN OF A LIFETIME

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K-69 EACH

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New, complete two-way speaker system —
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Size: 23 $\frac{1}{8}$ " H, 27 $\frac{1}{2}$ " W, 15 $\frac{1}{2}$ " D.

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The Largo 12 is available under the exclusive Permoflux Insured Home Trial Plan (HTP). Try it in the comfort and quiet of your own home for 15 days—with your own records and associated equipment. For a limited time only, each HTP participant will receive—absolutely FREE—the new Permoflux "Maestro" speaker-Headset Control Box (\$10.00 value). Also available under HTP: the Diminutive (\$49.50); the Largo 8 (\$99.75).

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Servicing Color TV

(Continued from page 52)

would not have any noticeable effect because all components of the Y signal would be affected similarly. Hence, this trouble could not be detected by simply viewing a color picture in black-and-white. The best testing device would again be a color-bar generator.

It is possible, although not as likely, for the delay line to introduce too much delay. In that event the brightness signal would arrive later than usual at the matrix. In the color-bar pattern, the visual effect would be to alter the first part of each bar while the second half would possess the proper brightness value.

In receivers of the I and Q variety, a delay line is also employed in the I channel. Any variation in its characteristics would not affect the brightness of color, but rather the color itself. This is because the I signal combines with the Q signal in the matrix to form the color signals which are fed to the picture tube. Any variation in either I or Q would then directly concern the amount of signal which the red, green, and blue control grids of the picture tube received and this, in turn, is directly related to the colors produced on the screen.

Color Instability

The last general category of troubles that affect the color of a picture is the inability of the receiver to maintain the color rendition constant. Symptoms of this condition may either be an erratic variation in color or the appearance of color bands moving down across the image. Reasons for this behavior usually stem from a defect in the color sync section of the receiver. For example, in the sync system shown in Fig. 3, the reactance tube may be defective, the phase detector may not be functioning properly, or the oscillator may be off frequency. Another possibility in this particular arrangement is a burst amplifier which is not amplifying or passing the color bursts properly.

In the ringing type of color sync system, there is less possibility of loss of color lock-in. This is because the crystal must be triggered (or shock excited) by the incoming bursts and this tends to automatically establish the phase of the generated 3.58-mc. oscillations. On the other hand, if the crystal is not triggered, no 3.58-mc. oscillations appear and, of course, no color. Once the 3.58-mc. signal is developed there are actually no components beyond the ringing circuit which can cause the color to fluctuate. The color, of course, may be shifted from its true value, but this shift is fixed and rotation of the hue control will ordinarily bring it back to normal. This is not a defect since the circuits are operating within their designed limits.

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New Test Equipment

(Continued from page 43)

stages and i.f. amplifiers. These generators should have an over-all frequency coverage from approximately 100 kc. to 30 mc. for use on receivers having very low intermediate frequencies and short-wave bands. Good shielding and accurate dial calibration are important factors to be checked in the selection of these instruments. If the generator has d.c.-isolated output, the output cable can be connected to test circuits containing d.c. voltage without need for external blocking capacitors. Internal modulation is also a desirable feature because it provides an audio signal from the loudspeaker for signal tracing.

Audio Test Equipment

The audio service field is still untapped by many service technicians, although opportunities for custom installations and servicing, particularly in the high-fidelity field, are many. The investment required for a basic test instrument setup is modest because most service shops already have a v.t.v.m. and oscilloscope. Addition of a good-quality audio oscillator, an audio voltmeter, and, possibly, a square-wave generator should provide the technician with an excellent equipment lineup.

The audio oscillator should provide essentially sine-wave output from approximately 20 cps to 100 kc. Output should be as free from hum as possible and the output circuit should work into loads ranging from a few hundred ohms to 100,000 ohms or more. The audio oscillator can be used in a great variety of applications, including frequency-response checks of amplifiers, tone-control circuits, and phonograph equalizers; measurement of the input and output impedance of amplifiers; determination of the resonant frequencies of loudspeakers; tuning of bass-reflex enclosures; and troubleshooting by signal injection.

Audio voltmeters are especially useful because of their flat frequency characteristics, high sensitivity, and good accuracy at low a.c. voltage levels. The square-wave generator is particularly valuable because it provides a means for quick determination of amplifier response at both low and high frequencies, phase shift, and transient-response characteristics.

Distortion meters are also important to the professional audio service shop because of their ability to measure accurately harmonic and intermodulation distortion and noise.

Despite the variety of test instruments available today, successful servicing still requires technique as well as good equipment. Increased service revenue and personal satisfaction will accrue to the service technician who employs a complete line of instruments with a full knowledge of their capabilities and their limitations.

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There's a "secret" to fixing old radios fast and profitably ... and Ghirardi's big 744-page, manual-size RADIO TROUBLESHOOTER'S HANDBOOK is it!

No other guide like it! Gives common trouble symptoms and remedies for over 4,800 models of old home receivers, auto radios and record changers. Contains tube and component data, charts, circuits, etc., available from no other source.

Even beginners can handle jobs slick as a whistle. Makes it easy to repair old sets for which specifications and how-to-fix-it data are no longer available. Just look up the model you want to fix. Four times out of 5, this giant Handbook leads you right to the trouble. ... shows exactly how to fix it. No useless testing. No guesswork. You repair sets in a jiffy that would otherwise go to the junk pile because no one knows what to do with them.

There are over 400 pages of troubleshooting and service case histories. In addition, you get over 300 pages of helpful I-F transformer data; superb re-alignment data and alignment peaks; handy troubleshooting reminder charts; auto radio gear ratios; complete data and characteristics on old tube types and components; tube substitution data ... and dozens of other invaluable service tips and ideas.

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5030 5857 6350 6875 7606 7840 8325	6125 6625 7350 8375
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Variable speed from
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Uses linked tones.
Brand New \$19.95

Set of 3 different
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Spec.—300 KC or 500 KC in FT-241A Holder. \$1.79 ea.

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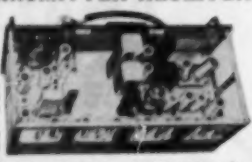
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Freq. range 415-420 MC, 5 stages of 30 MC. 1F amplifier. Complete with H.F. and L.F. sections. Less dynamotor, tubes, and tube shields, with schematic. Excel. cond. Weight 14 lbs.



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MANUFACTURERS' LITERATURE

The various listings presented in this section are for your convenience. The bulletins, unless otherwise indicated, are available to all our readers. For prompt attention write directly to the manufacturer for this literature.

INTERFERENCE FILTERS

Tobe Deutschmann Corporation, Norwood, Mass. has issued a two-page engineering bulletin, No. F-102, entitled "Guide to Specification of Interference Filters."

The publication presents 27 electrical, environmental, and mechanical check points when designing, selecting, or specifying electronic noise filters. The reverse side of the bulletin has a handy decibel conversion chart.

POTENTIOMETER LINEARITIES

To assist in the selection of the type of linearity which the application of a potentiometer demands, while remaining consistent with economic considerations, the Engineering Department of Clarostat Mfg. Co., Inc., Dover, N. H. has issued a bulletin covering the definitions of four different types of linearities; independent, zero-based, terminal, and index-point.

The bulletin is illustrated with the pictorial output of each type of linearity. A copy of Form No. 753813, "Linearities Defined and Compared," is available on request.

RECTIFIERS AND DIODES

International Resistance Company, 401 N. Broad Street, Philadelphia 8, Pa. is now offering a catalogue data bulletin covering its line of "Microstak" selenium rectifiers and selenium diodes.

The 8-page publication carries comprehensive data on construction, applications, types, ratings, reference curves, specifications, d.c. characteristics, etc. in addition to charts and graphs.

When writing for this publication, please specify bulletin SR-1A.

STORAGE EQUIPMENT

Bernard Franklin Company, Incorporated, Bath and Hedley Streets, Philadelphia 37, Pa. has issued a 16-page catalogue describing many new items added to its standard line of steel shelving, cabinets, bins, trucks, stools, and other storage and maintenance equipment.

Detailed information is provided on applications, construction, and specifications. Complete engineering layout assistance is also offered without obligation. Write Dept. 72-14 for a free copy of this catalogue.

MICROPHONE BROCHURE

A four-page brochure, published by Frank L. Capps & Company, Inc., 20 Addison Place, Valley Stream, N. Y., is now available covering the firm's

complete line of new dynamic microphones as well as its condenser microphones.

The literature is available without charge to those requesting it from the company.

MODULAR CONSTRUCTION DATA

Monson Manufacturing Corporation, 6059 W. Belmont Ave., Chicago 34, Ill., is now offering a catalogue page picturing and describing its new line of flat rectangular modular construction bobbinless precision non-inductive wire resistors.

Full technical information includes data on fiber glass epoxy or polyester resin housing, vibration and shock resistance, temperature characteristics, resistance range from 1/10 ohm to 2.5 megohms, tolerances, resistance wire, terminals, etc. A table showing typical sizes and resistances available in the new line is also included.

SUPREME'S "MASTER INDEX"

Supreme Publications, 1760 Balsam Road, Highland Park, Ill., has published a new "Master Index" covering its series of radio and television servicing books.

This 1955 index cross-indexes all material in the nine TV manuals and the fourteen radio manuals issued to date.

Copies of this new index are 25 cents each and are available direct from the publisher.

CENTRALAB CATALOGUE

Centralab, a division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis., has issued a comprehensive catalogue covering its line of electronic components for industrial electronics and television and radio servicing.

Catalogue No. 29, a 48-page publication, carries complete specifications on the firm's line of volume controls, switches, capacitors, printed electronic circuits, and steatite insulators. All products are pictured and complete specifications and application data are provided.

Write the company direct for a copy of this new catalogue.

RETMA INDUSTRY GUIDE

The Radio-Electronics-Television Manufacturers Association, 777 14th Street, N.W., Washington 5, D. C., has just released a report detailing the results of an 18-month study which was designed to improve the distribution of electronic parts.

The report, "Unit Territory Plan . . . to Serve the Jobber Better" includes

an introduction and a discussion of the problem, recommended solution, and the conclusion. In addition to the text of the suggested "unit territory plan," the report includes a map of the U. S. which is divided into 30 proposed territories for manufacturers' representatives.

A copy of this publication will be made available to interested industry members, whether or not they are members of RETMA.

"THIS IS HIGH FIDELITY"

An interesting, two-color booklet explaining high-fidelity reproduction of voice and music is being offered by *Allied Radio Corporation*, 100 N. Western Ave., Chicago 80, Ill.

Entitled "This Is High Fidelity," the text material is written in non-technical language and explains the functions of the basic units which are used in home high-fidelity music systems. Many installations are illustrated. A special section shows ways of modernizing existing equipment.

A copy of this new 16-page booklet is available without charge.

ATR CHARTS

American Television & Radio Co., 300 E. 34th Street, St. Paul 1, Minn., has announced the availability of two new wall charts of interest to technicians.

The first publication is an "Auto Radio Vibrator Wall Chart" which incorporates complete cross reference vibrator equivalent charts, vibrator specifications, base diagrams, and popular auto radio vibrator replacement types.

The second chart, "Inverter-Recorder Selection Chart," covers all standard a.c. tape recorder models and enables anyone to determine at a glance which inverter should be used for any given tape recorder depending on where the unit is to be used, whether in autos, trains, planes, or d.c. districts.

Both of these charts are being distributed without charge.

PILOT LIGHTS

Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y., has issued a brochure which describes its new line of subminiature pilot lights of the one-terminal type for use on grounded circuits.

The line requires a single 15/32" clearance hole and is intended for use with T-1-3/4 bulbs which are tiny incandescent lamps known as the midjet flanged type. Voltages range from 1.3 to 28.

Five different groups are described. Each type is illustrated with photographs and dimensional drawings. Full specifications are also provided.

Copies of Form L-157 are available without charge by writing R. E. Greene at the company.

EQUIPMENT CATALOGUE

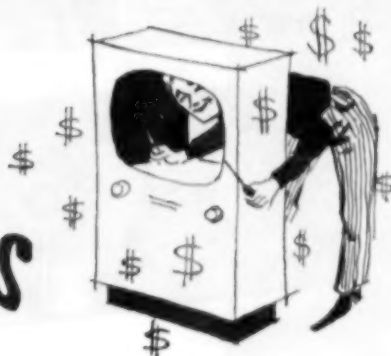
General Industrial Co., 5725 N. Elston Ave., Chicago 30, Ill., has issued a

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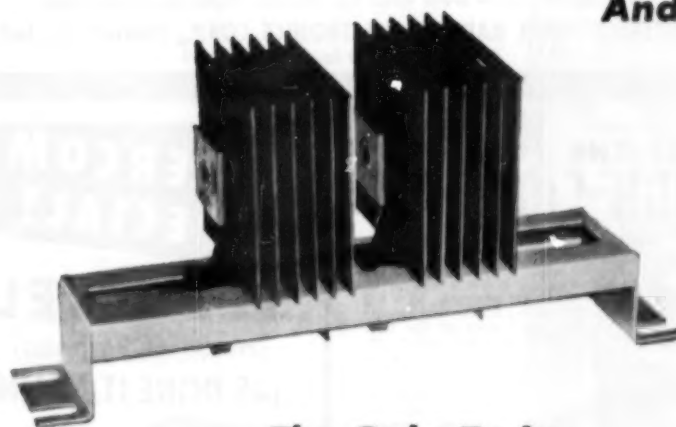
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"HIGH FIDELITY HANDBOOK"

Voice and Vision, Inc., 53 E. Walton Street, Chicago 11, Ill., has issued a 128-page handbook which is designed as a guide for planning home music systems.

The book includes a simple introduction to high fidelity, details on planning a home music system, custom installations, hi-fi radio equipment, phonograph equipment, amplifiers, tuners, speakers and speaker systems, tape recorders and accessories, microphones and accessories, binocular and stereophonic components, television, equipment cabinets, etc.

All of the products are illustrated and described in detail, making this a comprehensive catalogue of currently-available audio components. The catalogue is priced at 50 cents a copy, refundable upon receipt of the first order.

SOUND FILMS CATALOGUE

A 36-page catalogue which provides full information on the company's sound motion pictures and slide films is now available from Westinghouse Electric Corporation, P.O. Box 2099, Pittsburgh 30, Pa.

The publication, B-6505, covers a variety of subjects and provides complete film information that will assist in promoting showings to all organized groups, such as church, social, professional, civic, and business. The film subjects are listed and classified into three groups; general interest, product information, and training films and instruction courses.

RETMA BOOKLETS

Radio-Electronics-Television Manufacturers Association, 777 14th Street, N. W., Washington 5, D.C. has issued a new booklet entitled "Organization, Function, and Operation of Industry Advisory Groups" which explains in detail the work envisioned for these groups and the important part they play in advancing the technical proficiency of television technicians.

These committees, according to the booklet, are of utmost importance in coordinating local interests and establishing courses based on methods, curricula, manuals of instruction, and special equipment for training and teaching methods developed under the supervision of the RETMA Service Committee.

In addition the group released a leaflet containing comments from industry executives regarding the value of the course in advanced television servicing techniques, developed by the

RADIO & TELEVISION NEWS

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Association for use by local trade and industrial schools. The leaflet is entitled "What They Say About the RETMA's Course in Advanced Television Servicing Techniques."

Both publications are available on request.

FREED CATALOGUES

Freed Transformer Company, Inc., 1715 Weirfield Street, Brooklyn 27, N. Y. is now offering two new catalogues covering its transformers and laboratory test instruments.

The Catalogue No. 545 is a 24-page bulletin, completely indexed, which contains illustrations, dimension tables, technical specifications, and complete descriptive material on the firm's transformers, filters, magnetic amplifiers, reactors, and toroidal inductors.

The other catalogue, No. 546, covers laboratory test instruments including voltmeters, megohmmeters, filters, and magnetic voltage regulators. All technical specifications are given in this bulletin.

JOBBER SOUND PRODUCTS

Altec Lansing Corporation, 9356 Santa Monica Blvd., Beverly Hills, California or 161 Sixth Avenue, New York 13, N. Y. has released a new catalogue covering its line of "Jobber Sound Products."

The catalogue gives complete data on eight different *Altec* microphones including the special scientific condenser microphones for the measurement of high-intensity sounds and the newly-developed heart microphone for cardiovascular research. Amplifiers, speakers, horns, cabinets, and 70 volt transformers are also included in this compact yet comprehensive publication for those interested in audio gear.

CATHODE-RAY TUBES

The Tube Department, *General Electric Company*, Schenectady 5, N. Y. has issued a new 40-page de-

signer booklet on cathode-ray tubes for industrial and military applications.

The booklet (ETF-985) provides data on 24 standard G-E tube types and describes the company's engineering and production facilities available to meet specialized customer requirements. The tube types covered are used in oscilloscopes, radar indicators, industrial television, and TV studio monitors.

Technical information in the booklet includes tube essential characteristics, gun design factors, and a description of standard phosphors covering color, persistence, and special response. —30—

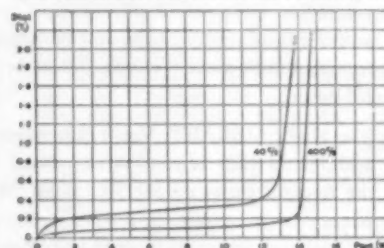
New British Amplifier

(Continued from page 47)

be interested in trying out this amplifier for themselves, your Editors are making arrangements to have this circuit modified by using American components throughout with the exception of the Mullard tubes which are actually the most important part of the amplifier and which will be available from your local jobber.

When this material is available, we plan to run construction details in our sister publication, *POPULAR ELECTRONICS*. Watch for this article. —30—

Fig. 4. Total harmonic distortion plotted against output power for the complete amplifier. Measurements made on the prototype amplifier using a Partridge PPO/1 output transformer. The PPO is shown in Fig. 1.

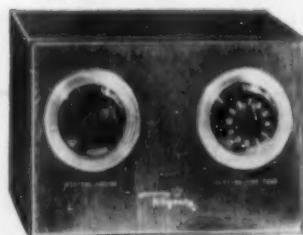


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(Continued from page 66)

typical characteristics of sharp close-to detail, but without the penalty of "deadness" . . . reverb having been added judiciously. The contrabasses are very weighty, indicating perhaps a shade too much enthusiasm by the engineer on the console. Other strings are nice and clean and woodwind reproduction is exceptional. The thunderstorm gives forth a solid ka-whop! for those of you who like spectacular "effects." I would suggest a db or two bass roll-off from the otherwise satisfactory RIAA curve.

WAGNER OVERTURES

New York Philharmonic Symphony Orchestra conducted by George Szell. Columbia ML4918. NARTB curve. Price \$3.98.

This is a particularly choice collection of Wagner warhorses. Such diverse items as the "Rienzi," "Tannhauser," and "Flying Dutchman" overtures keep company with the prelude to "Die Meistersinger." This sort of stuff is Szell's meat and he makes the most of it. Really rousing performances, which however, are never allowed to run away with themselves. First class sound from Columbia with brilliant brass and notable percussion. Curve and surfaces OK.

SCHUBERT SYMPHONY #8 (UNFINISHED)

TCHAIKOVSKY
ROMEO AND JULIET OVERTURE
Chicago Symphony Orchestra conducted by Antal Dorati. Mercury MG50037. RIAA curve. Price \$5.95.

This recording is several months old, having somehow slipped my attention. Since this is the 19th version of the Schubert, and the 22nd of the Tchaikovsky, time is hardly a factor in this case. Dorati is guest conducting the Chicago Symphony on this disc and as far as I am concerned, any further issues of these works would be superfluous. I'll get plenty of arguments on this score, but it seems to me that we have so many good performances of these works (including this disc) that sound quality should dictate the final choice. On that basis, this recording has the field to itself. The string tone that Dorati elicits from the Chicago orchestra is truly wondrous, a sonorous delight. This of course shows to great advantage in the Schubert and in the "Romeo." The "Romeo" is the showpiece here and is an astonishing example of the modern recording art. Dynamic range is unbelievable as is the exceptional orchestral balance and general lack of distortion. The assault of tympani, bass drum, and cymbal is awesome, a regular tube poppin' cone-crackin' jamboree! The brass sounds out brightly and bravely, enrobed in the fabulous acoustics of Orchestra Hall. Highly recommended to newly-minted hi-finatics or to those contemplating the upgrading or replacement of these works in their libraries.

STRAVINSKY THREE MOVEMENTS FROM PETROUCHKA RAGTIME SERENADE IN A

Marcelle Meyer, pianist. Haydn Society HSL113, NARTB curve. Price \$5.95.

"Petrochka" on the piano, by Gad! Yes, it is as difficult as it sounds! This is a fascinating disc and one which all of you who own orchestral versions of "Petrochka" should have. It is quite an experience to hear Miss Meyer play this incredibly complex music on

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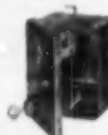
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the piano and to follow along with your mental "orchestration"! Stravinsky excerpted these three movements from the suite and transcribed them to piano in 1921. As you listen, you realize that in transposition, Stravinsky has carried over as many orchestral "effects" as are technically feasible for piano. This is a formidable work for any pianist and Miss Meyer is to be commended for her facile performance as well as forgiven for her missed notes and other falls from grace. "Ragtime" is a product of Stravinsky's experimentation with jazz and the "Serenade" one of his "neoclassic" inspirations, interesting mainly as curious. Good robust piano sound on this disc, fairly wide in range and with excellent dynamics. This action of the hammers could be discerned, a minor annoyance. Sharp, close-up recording is augmented by fair acoustics. The NARTB curve was adequate with my setup.

**WEBER
SIX SONATAS FOR VIOLIN AND
PIANO**

Ruggiero Ricci, violinist and Carlo Bussotti, pianist. London LL1006, RIAA curve. Price \$3.98.

A first recording on LP, these are very beguiling little works, lightly confected and utterly charming. Written when Weber was 24, they are among his first works to show a glimmering of the Romanticist that was to be. Not by any imagination can they be termed technically difficult, but they still serve Ricci nobly as display pieces for his rich clean tone and impeccable musicianship. Bussotti is, as always, a completely sympathetic accompanist. Superb violin and piano sound, slightly overbalanced in favor of the violin.

**DEBUSSY
THREE NOCTURNES
THE AFTERNOON OF A FAUN
MARCH ECOSSAISE**

Orchestre National de la Radiodiffusion Française conducted by D. E. Inghelbrecht. Angel 135013. RIAA curve. Price \$5.95.

This recording was awarded the Grand Prix du Disque in 1954 and after listening to it, the reasons for this honor are very apparent. The performance of the "Nocturnes" and the "Faun" is easily the best available at present. Debussy's friend and specialist, D. E. Inghelbrecht, knows the perils of this seemingly innocuous music and eschews the heavy hand which has been the detriment of many other recordings. The sound is one of the best examples of Angel's luminous, almost transparent-textured type of recording. Silken, edgeless strings are combined with ethereal woodwinds and brass of noble timbre. Yet for all this delicacy, so appropriate in this music, the sound has plenty of strength and body. Percussion, when called for, has punch and authority. The choral work in the "Sirenes" section of the "Nocturnes" is of great beauty and superbly balanced. The "Marche Ecosaise" or "Scotch March," was commissioned by a Scotsman, who had an old bagpipe theme played for Debussy, from which the composer evolved this spritely work. A good item for inclusion in "pop" programs, which might resurrect it from its comparative oblivion. The RIAA curve did not need adjustment.

**KIPNIS AS BORIS
Victor LBC-1082. RIAA curve. Price \$2.98.**

This is a re-issue of a 78 set many people have been waiting for, and a terrific buy at \$2.98. Alexander Kipnis, along with Chaliapin was one of the most able protagonists of the difficult role of "Boris Godounoff." Kipnis was that unique combination that opera

managers are always looking for . . . a great singer and a great actor. On this disc you will find the sections which are usually excerpted from the opera, such as the Coronation scene, Varlaam's Song, I Have Attained the Highest Power, etc. If you want a prime example of how a great singer/actor can move a huge audience to cheer themselves hoarse with shouts of Bravo! and Encore! listen to Kipnis in the Death Scene. Unless you are the most beady-eyed of cynics, the supercharged emotion of tolling bells, the powerful and somber orchestral hues, the stark terror of the tormented Boris' last gasping breaths will chill you to the bone! Good orchestral and choral work throughout the disc and the Victor engineers have revitalized the sound with reverberation and other trickery. The big bells and the climaxes in the Coronation scene reproduce with surprising cleanliness although it is evident that frequency response is restricted. A good buy, but if sound is more important to you, you can get the same excerpts in a positively dazzling "New Orthophonic" recording conducted by Stokowski. Need I say that this added magnificence means more moola? A db of bass boost helped the RIAA curve and surfaces were quiet.

**BARTOK
DIVERTIMENTI FOR STRING
ORCHESTRA
TWO PORTRAITS**

RIAS Symphony Orchestra conducted by Ferenc Fricsay. Decca DL9748. NARTB curve. Price \$5.95.

This is the type of recording that calls for some fence sitting! By this I mean that one must consider the authority of the readings by an acknowledged Bartok expert, Ferenc Fricsay; the fact that the "Divertimenti" is better sounding than the other available version on Victor, and the fact that the "Two Portraits" sound better on Peter Bartok's own label! For many, the excellence of the orchestra, and the splendid interpretation and the justness of the coupling may be the deciding factor. Good, clean, if not outstanding sound of the "big hall" European type. The NARTB curve was better with some bass boost.

**BRAHMS
CONCERTO #1 FOR PIANO AND
ORCHESTRA**

Artur Schnabel, pianist with Chicago Symphony Orchestra conducted by Fritz Reiner. Victor LM1831. RIAA curve. Price \$3.98.

I'm going to go out on a limb and state that I think this is the best sounding piano concerto since the advent of LP. Strong language, but listen to this disc for a few minutes and you'll see what I mean. For some time I have felt that the over-the-podium-condenser mike technique, or some modification of it, should be applied to concerto recording. This has come to pass in this recording and the results are astounding. That magic amalgam of superb detail and ultra-live acoustic perspective which is a characteristic of this type of recording, brings to the piano a freshness and presence that is uncanny. Chords are clear and unclouded, there is no harsh ringing, the piano may be played quite percussively without hammer action noise. Rubenstein must have been electrified at the sound of the first playbacks, and derived inspiration therefrom, for his performance is among the greatest I have been privileged to hear. Reiner is in splendid rapport with the pianist and maintains a superb balance of all elements throughout the recording. The orchestral sound is as illustrious as the piano, with smooth clean string tone, very bright punchy brass, and the imposing percussion which is almost a "trademark" of the Chi-

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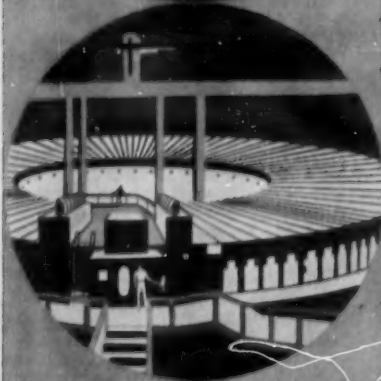
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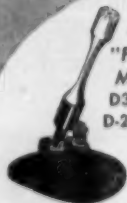
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cago Symphony in the acoustics of Orchestra Hall. Even if you own the other eight versions of this work, don't miss this one! This is a magnificent disc and it is unreservedly recommended. The RIAA curve did not need adjustment.

DELIUS

APPALACHIA
KOANGA (CLOSING SCENE)
Royal Philharmonic Orchestra and Chorus conducted by Sir Thomas Beecham, Columbia ML4915. NARTB curve. Price \$3.98.

Delius fans will be delighted with this new recording since the old versions on 78 rpm have been out of print for many years. This is typical Delius "tone painting" and stems largely from his residence in Florida. There is more than a hint of folk tune derivation, which lends an earthy vigor to the quasi-mystical Delius scoring. These are very ingratiating works which should find favor with an ever widening audience. Sir Thomas is, of course, the Delius interpreter *ne plus ultra*, and in this recording he gives further evidence of his mastery with a reading which is obviously a labor of love. The sound is generally good, although thick-textured in spots. Notable are string tone and the brief choral passages, and above all, a superb balance is maintained. Try this for a refreshing change. The NARTB curve was better with a little bass and treble boost, to my ears.

VERDI ARIAS

Robert Weede, baritone with The Concert Arts Orchestra conducted by Nicholas Rescigno, Capitol PB279. RIAA curve. Price \$5.95.

Here is one of those strange cases where the artist has as fine a voice as exists today but whose reputation has not kept pace with his talents. Weede's voice is a magnificent instrument, resonant, suave, facile, and with phenomenal dynamics. On this disc he is heard in arias from "La Traviata," "Rigoletto," "Don Carlo" and others. In all, his vocalizing is entirely convincing and is accomplished with easy grace. Weede gets fine support from Rescigno and the Concert Arts Orchestra, although some of the conductor's tempi would not be termed "ideal." The sound is excellent throughout. Some may quibble that Mr. Weede is recorded too close to the mike, but I think in this case, it adds to an already magnetic "presence." The RIAA curve did not need adjustment.

SIBELIUS

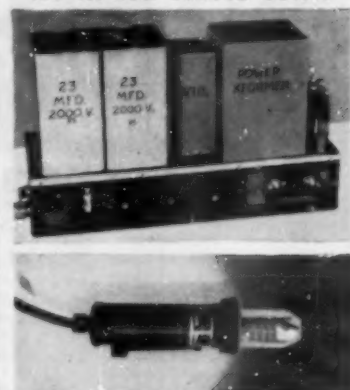
SYMPHONIES #3 AND #7
London Symphony Orchestra conducted by Anthony Collins, London LL1008. RIAA curve. Price \$3.98.

SIBELIUS

SYMPHONY #4
POHJOLA'S DAUGHTER
London Symphony Orchestra conducted by Anthony Collins, London LL1059. RIAA curve. Price \$3.98.

London continues its survey of the Sibelius symphonies and tone poems under the able baton of Anthony Collins. These are among the most satisfactory orchestral recordings issued by London. The sound is really magnificent, and is distinguished by ultra-wide frequency response, tremendous dynamic range, and the quietest surfaces I've heard from London in a long time. Richly sonorous string tone and weighty, brilliant brass are notable features. The "Third Symphony" is played very little in this country and I for one, can't understand this neglect. The work is comparatively gay for Sibelius and contains some of this composer's most clever scoring. If you want to hear a really rich orchestral passage, rich in sound and scoring, listen to the opening movement of this "Third Sym-

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phony." Simply fabulous! The "4th" and "7th" benefit from the superior engineering as does the interesting "Pohjola's Daughter." Collins has by now been acknowledged as one of the most astute of Sibelius interpreters and these present recordings are further evidence of his mastery. If you have never looked beyond the "1st" or "2nd" symphonies of Sibelius, try these recordings for a thrilling new experience with this great composer.

BUXTEHUDE

TWO CANTATAS FOR SOPRANO, VIOLINS, AND CONTINUO TWO CANTATAS FOR CHORUS AND INSTRUMENTS

Helen Boatwright, soprano, with Choir of St. Thomas' Church, New Haven, conducted by Howard Boatwright. Over-tone 6. RIAA curve. Price \$5.95.

Overtone Records keeps on turning out discs of more than passing interest. The program may seem formidable to you, but it is very easy to assimilate and is most enjoyable music. Helen Boatwright is justly famous for her oratorio singing, and she is heard to particular advantage on this disc in "Herr, auf dich trau' ich." Husband Howard conducts the beautifully trained choir with a devoted hand and achieves some extraordinary textures. The sound is exemplary throughout the work and you will delight in the smooth articulation of the choir and lack of fusion or blasting. Wide frequency response and dynamic range, coupled with a "just right" acoustic perspective adds to an attractive disc.

GRIEG

SIGURD JORSALFAR SUITE
Cincinnati Symphony Orchestra conducted by Thor Johnson. London LD-9138. RIAA curve. Price \$2.98.

The name of this work may be totally unfamiliar to you, but when you hear the "Homage March" from it, you will recognize the music as something you have often heard at "pop" concerts. The work was written as incidental music for a play based on old Viking legends. The suite from the play is in three sections and contains much writing that is sonically exciting. This will appeal to hi-fi fans with its rousing brass and woodwind reproduction and spine-tingling percussion. One of the best of London's "American" recordings, it will no doubt find use as a demonstration disc. The RIAA curve was adequate.

LE GROUPE DES SIX

A Tribute to Georges Aurio, Louis Durey, Arthur Honegger, Darius Milhaud, Francis Poulenc, and Germaine Tailleferre. Angel 3515-B. RIAA curve. Price \$11.90 (two discs).

If you are a lover of music *moderne* and French, then you can't afford to be without this album. From its gay cover to the spoken introduction by Jean Cocteau and the succeeding music, this is a fascinating glimpse into the musical microcosm of the group known as "Les Six." In November of 1953 Georges Tzipine conducted the Orchestre de la Societe des Concerts du Conservatoire in a gala anniversary concert devoted to the music of "Les Six." Angel has very thoughtfully provided us with a recording of that concert and it is certainly an interesting documentary (if it can be called that). One might quibble with the choice of music, since it is mainly the latterday output of "Les Six" and not too characteristic of the work of this *avant garde* group of 30 odd years ago. The woman in the group, Germaine Tailleferre contributes a frothy little overture, Louis Durey who succeeded from the group many years ago, is represented by his "Cantata" set to a poem by Cocteau. The versatile

March, 1955

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Poulenc contributed his secular cantata "Scheresses" (Drought). Georges Auric, who you may be surprised to learn is the composer of the popular ballad, "The Song from Moulin Rouge," is represented by the symphonic suite, "Phedre." The great Arthur Honegger is honored with his "Prelude," "Fugue," and "Postlude" and the redoubtable Darius Milhaud gives us his "2nd Symphony." This is highly varied music and I find my preferences leaning to the Auric, Honegger, and Milhaud works. Auric's "Phedre" has been criticized as being too "theatrical," but I like the scoring and orchestration, and there is much in it that will appeal to the hi-fi fan. Honegger's work is a powerful evocation which rather clearly shows his debt to German romanticism. The Milhaud symphony is in five movements and is an amiable work, not at all like the athletic and dissonant "1st Symphony." There is some splendid sound in this album, especially in "Phedre" and the Milhaud symphony. String tone is of the ultra-smooth type *Angel* has been noted for lately; woodwind sound, as might be expected in an album of French music, is exceptionally pure, and *Angel* continues to demonstrate that they know how to record percussion of notable impact and cleanliness. A most attractive booklet comes with the album and is well filled with information and pictures regarding "Les Six." The RIAA curve did not require adjustment in my setup. Surfaces were quiet.

DONIZETTI

THE ELIXIR OF LOVE

Margherita Carosio, soprano; Nicola Monti, tenor; Tito Gobbi, baritone; Melchiorre Luise, bass; Loretta di Lelio, soprano, with Orchestra and Chorus of the Opera House, Rome, conducted by Gabriele Santini. Victor LM6024. RIAA curve. Price \$7.96 (two discs).

With the new prices in effect, more and more people will probably indulge themselves in opera albums. Here is a good one to start with from the standpoints of quality and economy. The second complete recording on LP, this is a much superior recording than the earlier *Cetra* and has the added advantage of being on two discs instead of three. All of the soloists here are more than competent and the artistry of Carosio is a most amazing surprise. Santini seems to be an old hand with the score and if his reading is "unsensational," neither is it full of idiosyncrasies of tempi or temperament. The sound is fairly wide range, with little distortion and good dynamics. Highly recommended.

BRUCKNER

SYMPHONY #3 in D MINOR

Vienna Philharmonic Orchestra conducted by Hans Knappertsbusch. London LL1044. RIAA curve. Price \$3.98.

This record arrived without fanfare, yet it is more than likely that this recording will prove to be "epochal." Why? Because it is the Bruckner recording with really modern high-fidelity sound. This is of the utmost importance in the works of this composer. Many (Continued on page 139)

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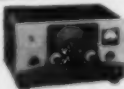
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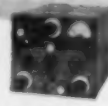
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stand the test of time. Performance-wise, the Firkusny reading on *Columbia* is the only possible competition. Curzon is in his element with this sort of repertoire, and his easy grace and unhurried phrasing belies the wiry strength of his reading. In the "Kinderszenen," Curzon is equally matched with redoubtable Novaes, and I feel his expressiveness is superior. In matter of sound, it is strictly no contest. The *London* engineers have cloaked Curzon's performances in the sort of clean-lined, liquidly beautiful piano sound for which they are justly famous. The RIAA curve did not require adjustment. Surfaces were moderately quiet.

HANDEL

THE MESSIAH

Huddersfield Choral Society conducted by Sir Malcolm Sargent. Angel 3510C. RIAA curve. Price \$17.85 (three discs).

Those of you who have been holding on tightly to your old *Columbia* recording of this work, which employed the same forces, can relax now. The battle is over. You have bravely resisted the blandishments of the "Handelian version" on *Westminster* and the "Dublin version" on *London* and this is your reward . . . a bright new high-fidelity recording. This is the "Messiah" in the grand traditional manner. The chorus is robust. Sir Malcolm's performance is energetic and exciting. Climaxes are meant to be big and are big! The usual cuts are observed and as a consequence there are three instead of four discs in this album which, of course, means some money saved. The Huddersfield group is as accomplished here as they were in the old *Columbia* album. Soloists are of a high level of excellence, especially "old reliable" Richard Lewis. The Liverpool Philharmonic is once again employed and since this is probably its 6999th performance of the work, its authority is unquestioned. Splendid sound throughout the disc, with clean smooth strings, the rousing high-register trumpets, and the power of the very sonorous organ a delight to the ear. The over-all sound quality of the *London* version is somewhat better, but if you crave the traditional in "Messiah's," you won't go wrong with this recording!

BRAHMS

FOUR SERIOUS SONGS TWO SONGS FOR CONTRALTO WITH VIOLA OBBLIGATO IN STILLER NACHT SANDMANNCHEN

Nell Rankin, contralto, Coenraad V. Bos, pianist, Carlton Cooley, viola. Capitol P8289. RIAA curve. Price \$5.95.

This is quite outside the usual repertoire of *Capitol* and is further proof of its versatility. The recording is absolutely first rate in every respect. The attractive Miss Rankin has one of the most glorious contralto voices in existence and her performance of these lieder is a triumph of no mean proportion. The astute Mr. Bos must share in the plaudits for his coaching and sympathetic accompaniment. Mr. Cooley, first viola of the late lamented NBC Symphony contributes his beautiful tone to the proceedings. Miss Rankin's voice is recorded somewhat "close-to" but reproduces splendidly. Nice clean piano and viola sound add to this fine recording. If you like lieder, this recording is a must.

SCHUMANN

SYMPHONY #4

LISZT

LES PRELUDES

Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50036. RIAA curve. Price \$5.95.

This is the performance and recording of the month! The amazing Mr. Paray keeps on scoring one bull's-eye after another. I know

dozens of really rabid hi-fi fans who wouldn't give you a nickel for any Schumann symphony, who will flip with this one. I have long contended that *really good* recording will make the so called "classic" repertoire not only acceptable, but enjoyable to many formerly indifferent people. This is Schumann such as you've never heard before. Paray brings an earthy vigor to this work and imbues it with new strength. This is definitely not a Viennese performance and you are so forewarned. It is a new look, a new approach and I, for one, like what I hear. The sound is ultra-wide range with the most remarkable characteristic the wide ranging dynamics. Distortion is fantastically low. "Les Preludes" receives the same sort of vigorous treatment and the hi-finites will have a field day with this one. Absolutely tremendous bass drum, tympani, and cymbal sound, brass of overwhelming power. Watch your speaker cone with the dynamics on this disc! The RIAA curve did not need adjustment. Good surfaces in my copy.

Tape Review

SAINT-SAENS

CARNIVAL OF THE ANIMALS TOCH

PINOCCHIO

Sondra Biance and Gerhardt Arnoldi pianists with Hamburg Philharmonic Orchestra conducted by Hans-Jurgen Walther. A-V Tapes, AV-1513, 7½ ips, half-track.

Audio-Video has a sure winner in this tape and those of you who like the *Toch* work will find it does not exist on LP at the moment, so this is an ideal way to acquire the work. The pianists do a thoroughly competent job in the tricky passages of the "Carnival of the Animals." It is amazing how different piano sounds on a good tape. There is a sparkling liveness and solidity of tone not apparent even in the best of LP's. Strings are again the edgeless delight characteristic of their reproduction on tape. This is one of the most hi-fi tapes I've heard yet, with plenty of super-clean percussion and punchy brass. The *Toch* is a charming work and gets a workmanlike performance by the conductor. Very little distortion throughout the tape and tape hiss was barely noticeable. As played back on my *Ampex* 600, I had no equalization problems. One of the best commercial tapes now available.

NEW RECORD CLUB PLAN

MUSIC Appreciation Records, a new branch of the *Book-of-the-Month Club, Inc.*, has instituted a unique plan whereby subscribers not only receive a concert recording of some major classic but, on the reverse side of the same 12" disc, are offered an "analysis" of the music as prepared by leading critics. This analysis takes the form of a spoken commentary and illustrative passages from the music.

The plan is available in two forms, one for those who already own good recordings of the selections offered and the other for those who do not have satisfactory performances in their record libraries. For those who do not have the record, the 12" disc carries the selection and the commentary. A 10" disc offering just the commentary is available for those owning a good recording of the piece.

The recordings have been especially made for the club and are available in 33½ rpm only. A "preview" of the following month's record is sent each subscriber in advance for acceptance or not, as desired.

A VERSATILE CONNECTOR

By R. A. THOMASON

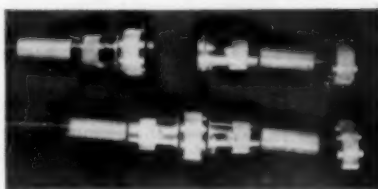
AS communication shop foreman for the Texas Gas Transmission Corporation, the author recently solved a problem which others may have faced.

In the shop we work on many different types of equipment which require the use of a wide variety of test gear. During the past few years we have accumulated an unwieldy bundle of test leads. With few exceptions, there never seemed to be a lead with the needed combination of connectors and, indeed, there were combinations which were never used. Sometimes as many as four test leads were connected in an attempt to reach the desired combination. These leads were in assorted lengths and wire sizes, causing veritable rats' nests and making them difficult to find.

Finally it was decided that what was needed was a set of test leads that would terminate at one end in a connector which would be common to all leads. This connector would have to meet the following requirements: well shielded, low-resistance contacts, mechanically strong, easily connected and disconnected, and both male and female.

One serious contender for this job was the Amphenol 75-MC1F microphone connector. It meets all of the specifications and is available at most distributors. The 75-MC1F is a female connector; however, it is quickly converted to a male by screwing the knurled cap back over the body.

Test leads were made with the 75-MC1F on one end and every other type connector needed installed on the other



Four of the connectors. (top left) a female unit, (top right) unit converted to male by screwing the ring back over the connector, and (bottom) units used together.

end. From two to four of each type of lead was assembled. By using the two proper test leads, every connector could be matched with any other connector or to itself. Also, two leads were made with the 75-MC1F on both ends, to be used mainly as extensions. All leads were made three feet long, using RG-58A/U coaxial cable. This coax is small and very flexible.

The total number of leads needed was reduced by taking advantage of the Amphenol 75-MC1F phone-plug adapter. This adapter converts the 75-MC1F to a phone plug. Only male coax connector test leads were needed because a straight adapter (such as the PL-258) permitted the units to be converted to female. Switchcraft makes a kit of adapters which has proven useful in this application.

These leads have been in use for some time now and everyone agrees that they really fill the bill.

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Mac's Radio Service Shop (Continued from page 105)

"That's the point. I'm going to sell these abbreviated test tapes for what they cost me to guys who want to borrow my D-110 tape. These little jobs sell for only a couple of bucks apiece, which is not much more than the cost of the raw, unrecorded tape; yet one of them will allow the owner to find out a surprising number of things:

"First, since the timing beeps are recorded exactly seven minutes apart at normal tape speed, the user of a D-210 tape can tell if his recorder is moving the tape too fast or too slow. With the 5000 cycle tone and the instructions sent with the test tape sampler, he can find out if his playback head is in proper alignment—something that is very important if he wishes to play the new pre-recorded tapes that are becoming so popular. To get the most out of these tapes, the head must be properly aligned. At the same time he can satisfy his curiosity as to just how good his recorder will sound when playing one of these high-fidelity tapes. If, before this time, he has only heard his recorder play music he recorded himself, he may be in for a pleasant surprise. Still more, the little sampler gives him a chance to examine and test the new thin tape that looks as though it will rapidly replace the 1.5 mil type for most applications. And finally—a most important consideration—if he happens accidentally to erase a part of this short test tape, the cost of replacing it will be but a fraction of what it would be if he had erased a portion of a professional test tape."

"I get it," Barney said. "You're just taking out insurance on your precious D-110 tape. Now, not to change the subject, I wonder if you can clear up a little mystery that has been bothering me. I've noticed several times that after we've replaced a picture tube the customer will call in and say that he believes the new tube has more snow than the old one had before it went sour. I notice you don't argue with him, but you simply say to keep an eye on the new tube for a few days and call again if this condition doesn't go away. Now why should a new tube have more snow and why should this snow disappear after the TV set has been running a few days?"

"There are a couple of things involved. In the first place, a new picture tube loses a substantial portion of its brightness during the first few hours of operation and then levels off to normal brightness that lasts pretty well for the life of the tube. This first abnormal brightness has a tendency to exaggerate any tiny amount of snow that is present. Secondly, the tube we took out was probably pretty dirty and any fine flecks of snow probably would have been obscured by the coating on the face of the tube. The new

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tube, on the other hand, has a nice clean face, and the owner can see even the tiniest specks of light that show up on it. You'll recall that customers sometime complain of increased snow when all we have done is clean the face of the tube and the safety glass in front of it."

"I suppose after a few days the abnormal brightness of the tube subsides and the face of it gets a little dirty and the 'increased snow' disappears and we hear no more from the customer."

Barney picked up from the bench a little coil that had a couple of leads with small clips on their ends soldered to it. "Hey, Boss," he said, "here is a little thing I've been using lately that I think, with all due modesty, is terribly, terribly clever of me."

"Doesn't look like much from here," Mac commented disparagingly. "All I can see is one of those slug-tuned antenna-substitute coils with a pair of test leads soldered to it."

"That's what it is," Barney admitted, "but the clever part lies in the use to which I put it. Loop antennas fastened inside console cabinets have always presented a problem when it is necessary to remove the chassis and take it to the shop for repair. Quite often they are hard to remove and replace; yet the set will not play satisfactorily without a loop antenna. That means we cannot check the operation of the set across the entire broadcast band unless we have the loop."

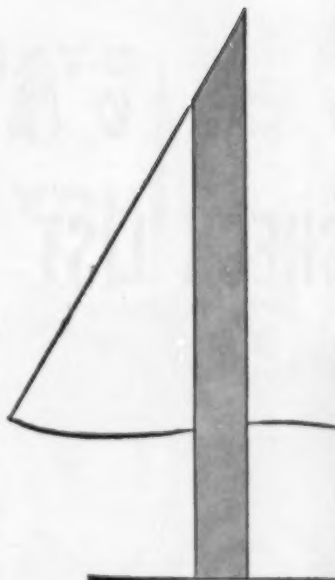
"I used to unscrew, unbolt, and unstaple the loops and bring them in, even though this meant a lot of extra work and there was always the danger the loop coils might be damaged while they were being lugged around. Old Barney does this no longer. He simply clips this little coil across where the loop leads connect and tests the set to his heart's content. The 'Loop-stick,' as it is called, will replace any high-impedance loop quite nicely. Of course, it cannot be used as a substitute for a low-impedance loop, but a large loop of wire will do nicely for that; or you can usually get good reception on such a set simply by clipping a long antenna to one of the low-impedance loop connections."

"What do you do about alignment?"

"I align everything I can right on the bench," Barney explained. "Then, when I return the chassis, I carefully align the trimmer that tunes the loop fastened in the cabinet. Lots of times this trimmer is right on the loop itself; but no matter where it is, I align it with the chassis in position in the cabinet. That is a much better way of doing it than it would be if I brought the loop along and aligned this trimmer while the loop was lying on the bench or dangling by its leads."

"Good boy," Mac applauded. "I do believe that you have that little lazy streak that is always hunting a better—and of course, easier—way of doing things that marks a good mechanic in any field; but just always be sure that the new way is better."

March, 1955

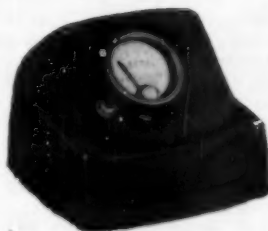
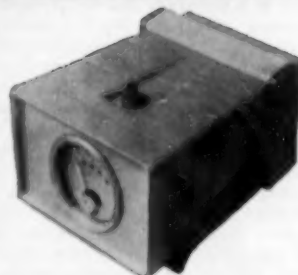


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AUDIO NOISE CHECK LIST

By MAJOR
EUGENE F. CORIELL, USAF

Armed Forces Radio Service

Much of the noise encountered in audio systems can be eliminated. Here are the "critical" areas to check.

NOISE is a constant hazard in audio systems of all kinds—the professional broadcast and recording installation, the music lover's home high-fidelity rig, and the lowly intercom. Hum is a special type of noise whose causes and cures differ more often than not from those of other noise disturbances. Since the writer has previously published a check list on hum¹, the present article deals with noise other than hum. The term "noise" as used in this article includes hiss, clicks, crackles, "hash," r.f. interference, and crosstalk. This material has been compiled from numerous sources in the literature and is intended as a ready reference list for the audio technician. For the reader who desires a fuller treatment, a working bibliography is provided in the "References" at the end of the article. Noise causes and remedies are given under the headings of "Amplifiers and Power Supplies," "Turntables and Disc Recorders," "Tape Recorders," "Interconnection Wiring and Grounding," and "Miscellaneous Noise Sources."

Amplifiers and Power Supplies

A. Tubes:

1. Check all tubes. Tube noise may include hiss, shot effect, and crackles from intermittent contacts within the tube².
2. In aggravated or critical cases, select the quietest tube of several of an identical type, particularly in pre-amplifier stages and especially if microphonic.
3. Tube type may be inherently noisy. Try a 1620 in place of a 6J7. The 5879 is also quieter than the 6J7 but requires a different socket. Triodes are generally quieter than pentodes for the same amplification.
4. Voltages may not be optimum for minimum noise. Try slight decrease of heater, plate, and screen voltages.
5. Check resilience of preamplifier

tube socket when checking for microphonics.

6. Clean tube socket contacts and tube base prongs—also the top grid electrode and its cap. Re-solder grid lead to the cap. Make sure the shielding cover is not intermittently shorting the grid cap and makes good contact with the metal tube shell.

B. Resistors:

1. Check all resistors. Resistor noise is usually an irregular frying sound lower in pitch than tube hiss, and is most critical in the lower level stages. Use only low-noise type resistors in these positions, such as deposited carbon or non-inductive wirewound types³. This precaution also applies to d.c.-carrying resistors in signal circuits of intermediate stages⁴.
 2. Value of grid resistor in first stage may be critical⁵.
 3. Suspect as noisy any resistor showing signs of overheating.
 4. Use resistors of larger wattage rating, since noise decreases with increasing physical size⁶.
 5. Excessive resistance in plate load resistor. Use only enough resistance for required gain, and provide any needed additional voltage drop by a separate, well-bypassed resistor⁷.
 6. Associated capacitor may leak d.c., causing the resistor to appear noisy.
- ### C. Capacitors:
1. Check all capacitors. These may become noisy due to leakage, loose lead connections to foil, or intermittent voltage breakdown. They may also change capacity with age and overheating.
 2. Check particularly all capacitors in critical positions such as coupling and decoupling capacitors. Replace paper type with molded units.
 3. Polarity may be important in paper types as well as in electrolytics.
 4. Omitted or defective output tube plate bypass capacitors to ground.

These are generally required to reduce circuit noises and r.f. disturbances, and may have values on the order of .001 μ f⁸.

5. Replace any electrolytic cathode bypass capacitors with paper type⁹.

6. Defective or omitted line filter capacitors from each side of a.c. line to ground.

7. Check all electrolytic capacitors in power supply. See also item E-12.

D. Volume Controls and Switches:

1. Loose wiper arms and dirty resistance elements and attenuator contacts. Clean carbon potentiometers with carbon tetrachloride or approved anti-noise solution, and clean attenuator contacts with a silicone preparation, petroleum jelly, or a non-gumming oil. Never clean attenuator contacts with carbon tetrachloride.

2. Noise due to intermittent breaks in resistance element or in internal connections to its terminals.

3. Control may appear noisy due to d.c. leaking to it from a defective capacitor preceding it, for example, a coupling capacitor.

4. Control may seem noisy due to disturbances picked up outside the amplifier, for example, noise picked up by improperly shielded and grounded input leads to a preamplifier¹⁰.

5. Volume control or switch located at a circuit point where the power level is too low to mask the normal noise of the element.

6. Switch contacts loose, dirty, corroded, or misaligned.

7. No capacitor across the switch or from each side of the switch to ground. Try capacitors in various combinations with resistors. When applying noise-suppression devices to signal circuits, always check for possible resulting unbalance, leakage, and other effects on audio performance.

8. Relay contacts are subject to same noise troubles as switches, plus possibility of pickup from coil-energizing circuit.

9. In multi-contact switches, such as broadcast console microphone keys, make sure contacts open and close in correct sequence to avoid momentary feedback howl. The d.c. contacts for the speaker relay should kill the speaker before the audio contacts connect the microphone. Also see section on "Miscellaneous Noise Sources" later in this article.

E. Other Amplifier and Power Supply Noise Causes:

1. Howling may be due to lack of shield on glass tube, excessive plate and screen voltages, defective plate and screen bypass capacitors, defective decoupling network, or acoustic coupling between loudspeaker and amplifier tubes or phono pickup.
2. Excessive gain per stage. Reduce gain of offending stage and if necessary, increase that of a later stage.
3. Feedback carried over too many stages¹¹.
4. Too low an impedance ratio in input transformer¹².
5. High-resistance leakage between suppressor grid and plate or screen.

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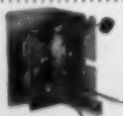
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When internal tube wiring permits, try connecting suppressor to plate or screen instead of to cathode¹².

6. Amplifier passband too wide for program material used. For example, when playing old shellac discs recorded with limited high-frequency response, turning down the treble control may reduce the scratch without materially reducing reproduction quality.

7. A special case of amplifier noise is the thumping sound from broadcast station limiter amplifiers while limiting, due generally to unbalanced push-pull tubes¹³.

8. Defective internal grounding in amplifiers. Shield and circuit grounds run to wrong points, poorly soldered, or omitted altogether. Ground the low side of all unbalanced amplifier circuits (which usually means the shield braid of high impedance circuits) to a common ground bus connected to the chassis at only one point—preferably near the preamplifier or first stage. Determine this point experimentally. Ground non-signal elements like transformer casings, glass tube shields and #1 pin of metal tubes directly to the chassis¹⁴. Chassis bottom cover loose or omitted. Amplifier or power supply chassis not grounded or improperly grounded to other chassis in the system. See section "Interconnecting Wiring and Grounding."

9. Intermittent opens in audio and r.f. filter chokes, especially where the winding joins the terminals. Also check for open or omitted r.f. chokes in mercury vapor rectifier circuits required to prevent noise from r.f. surges¹⁵.

10. Check dry-disc rectifiers in power supplies.

11. Motorboating. May be due to poor regulation of d.c. supply resulting from overloaded transformer, unbalanced push-pull tubes in output stage, excessive resistance in filter chokes and use of choke-input instead of capacitor-input filter circuit¹⁶. Motorboating may also be due to defective electrolytics and decoupling networks.

12. Internal impedance of power supply too high at audio frequencies. May be due to inherently poor regulation, or to amplifier distortion which causes excessive plate current drain. Susceptibility to noise pickup is increased by high internal power supply impedance across which stray fields induce noise voltages. Use regulated power supplies. Shunt small paper capacitor across electrolytics to counteract their inductance at radio frequencies. This reduces the internal impedance of the supply at r.f. frequencies and thereby tends to reduce r.f. pickup¹⁷.

Turntables and Disc Recorders

1. Excessive needle scratch. May be due to worn or broken stylus¹⁸, wrong type stylus¹⁹, defective recording; worn, scratched or dirty record. Wash dirty disc in cold water²⁰, or wipe with anti-static cloth, or use radioactive static-neutralizing brush such as "Static-Master" (available in photo supply

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stores). Disc may have been recorded with insufficient high-frequency pre-emphasis. Make sure turntable equalizer switch is set for the type of record being played.

2. Excessive needle-talk. May be due to defective or wrong type stylus, poor design of pickup cartridge¹⁹, or wrong mounting of cartridge in arm. Needle-talk may be emphasized at certain frequencies due to defective arm assembly or to acoustic coupling between stylus and loudspeaker.

3. Low-frequency noise mistaken for hum may be due to mechanical rumble resulting from out-of-round idler or driving pucks, excessive pressure between friction driving members, excessive bearing friction in pucks or in motor bearings, unbalanced rotating members, undue motor vibration, loose or hardened rubber motor-mounting grommets, misalignment of mating driving surfaces, or loose motorboard. This applies to both transcription playing and recording turntables.

4. Recording (cutting) stylus may have been worn, chipped, improperly mounted in cutter head, or set for wrong pressure and cutting angle²⁰.

5. Lacquer coating on disc may have been too hard, rough, or otherwise defective.

6. Misalignment of recording head carriage or associated parts.

7. Poor signal-to-noise ratio recorded on the disc, due to insufficient recording level or to insufficient pre-emphasis. Use of an electrically heated stylus materially improves the signal-to-noise ratio²¹.

Tape Recorders

1. Dirty heads. Clean with carbon tetrachloride or alcohol.

2. Poor grade of tape, or defective tape. Paper-backed tape results in more noise than plastic-backed tape of same magnetic characteristics.

3. Poor erasure. May be due to bad oscillator tube, misaligned erase head or other erase system defect. May also be due to improper use of bulk eraser²², use of d.c. or permanent-magnet erase, heavily recorded signal or switching transient, poor erase current waveform²³, or aging effect on tapes in storage. Try storing in warm room for a few days²⁴.

4. Wrong tape tension.

5. Insufficient bias current.

6. Poor bias current waveform, due to overloaded or poorly designed oscillator²⁵. Second harmonic of bias current should be 60 db below the fundamental²⁶.

7. Recorder inherently noisy due to use of d.c. bias.

8. Beats between bias frequency and harmonics of the audio signal, due to bias frequency being too low. Bias should have at least five times the frequency of the highest audio frequency to be recorded²⁷.

9. Recording level too low, thereby degrading the signal-to-noise ratio on the tape. Adjust professional machines with level-setting portion of an alignment tape.

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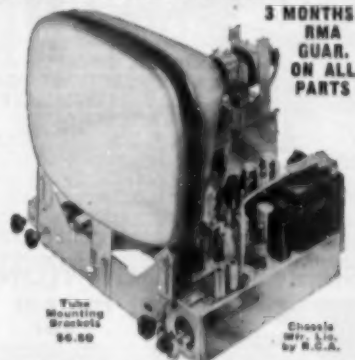
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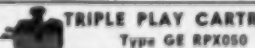
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for entire plant, resulting not only in noise but also in circuit instability, potentials between chassis, and interaction between circuits. Over-all ground system should be as carefully planned as the signal circuits¹⁰.

9. Lack of low-resistance earth ground for system. The d.c. resistance of the grounding conductor from the water pipe or structural steelwork of the building to any chassis should be only a fraction of an ohm at the very most.

10. "B-minus" of common power supply grounded to wrong point. Select this point by trial for minimum noise¹¹.

11. Ground cable shields at one end only to avoid ground loops. This also applies to patch cords.

12. Poor or intermittent contact between bare shields of pairs in cable bundle. Bond all such shields together at frequent intervals; better still, use only pairs with insulation over the shield.

13. Sometimes grounding the center tap of a transformer winding terminating a balanced line does more harm than good, noisewise¹². Such grounds should be applied experimentally. If other considerations require a center tap ground, try a pair of high resistances in series across the winding and ground their junction. The same general precautions apply to grounding the center taps of balanced pads and attenuators.

14. Electrostatic shield of repeat coils and input transformers not

grounded. This is especially important in avoiding r.f. pick-up¹³.

Miscellaneous Noise Sources

1. The r.f. interference due to switch clicks, fluorescent lights, household appliances, motor noise, and actual transmission signals. These troubles are due generally to r.f. conducted along—or re-radiated from—the building a.c. lines to the audio gear; or they may be due to r.f. pick-up by the leads of low-level audio circuits. Good shielding and grounding practices are a must. Use input transformers with a grounded electrostatic shield between windings, and try a 10,000 to 20,000 ohm resistor in series with the grid lead of the first tube directly at the grid pin or cap. Prevent rectification of the r.f. by resoldering all doubtful low-level connections and by cleaning all tube prongs, tube socket contacts and plugs, and other connectors. Use r.f. filters in a.c. lines, or use an isolation transformer with a grounded electrostatic shield in the main a.c. power line¹⁴.

2. Type of microphone used may have too low an output¹⁵ or the associated preamplifier may have too high a noise level, or both. These degrade the signal-to-noise ratio at the most noise-sensitive point in the system. Use a microphone with higher output and select the quietest tube of several for the first stage.

3. Noisy loudspeaker. May be due to (Continued on page 150)

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torn or brittle cone, voice coil rubbing the magnet, vibrating cabinet panels, or cabinet resonance at certain frequencies. Note that noises apparently due to the speaker may be due to room resonances at particular frequencies or to acoustic coupling between the speaker and the amplifier tubes or phono pickup.

4. Momentary feedback howl may occur when switching microphones at the console, due to slow release of speaker muting relays. (Broadcast practice is to have the relay coil de-energized when the studio speaker is "off" so that relay power failure will not cause feedback on the air). Add resistance to the relay coil circuit and/or adjust the armature stop screw. (See item D-9 under "Amplifiers and Power Supplies")

5. Tuner system noisy. May be due to antenna location in a noise field. Try re-orienting antenna, use a loop antenna or a noise-reduction antenna system. Also check for cracked insulators, bad soldered joints, frayed lead-in insulation, defective lightning arrester, defective converter tube in superhets, and insufficient de-emphasis in FM tuners.

6. Crosstalk due to output transformer of one amplifier being too close to the input transformer of another (of a different channel), thereby permitting electromagnetic coupling between channels.

7. Repeat coil (1:1 audio transformer) lacking between incoming remote line and amplifier input. Coil should have an electrostatic shield between windings, grounded to main audio ground.

8. Signal level allowed to fall below microphone level (generally considered minus 60 dbm), due to insertion loss of mixers, pads, equalizers, filters, etc. This reduces the signal-to-noise ratio. Use additional amplification ahead of such elements.

9. Weak or otherwise defective dry batteries in portable units such as broadcast remote amplifiers.

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TG-34A CODE KEYS

Self-contained automatic unit, reproduces code practice signals recorded on paper tape. By use of built-in speaker, provides code-practice signals to one or more persons at speeds from 5 to 25 WPM. BRAND NEW, in original carton... **\$16.88**



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THE cans from discarded fluorescent lamp starters make ideal shields for small coils. For temporary tests, they can be simply held in place. For permanent installations, a small "L" bracket, spring clip, or soldering lug may be used for mounting.

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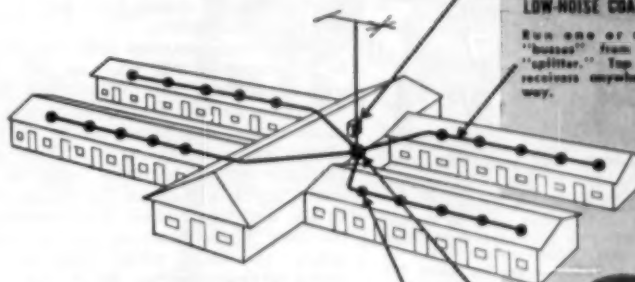
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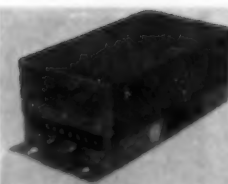
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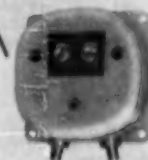
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Antenna Rotators

(Continued from page 61)

pected capacitor completely when making this test, as it may have a high leakage.

Small "frazzles" of wire on the terminal board beneath the control box will also cause much trouble, if they happen to cause a short. If the rotator runs part-way around, then suddenly stalls and hums, suspect a short, underneath. The return springs on the actuating switch may also give some trouble, through breakage. If an exact replacement is not at hand, one may be made using spring wire and a pair of chain-nose pliers.

Mechanical troubles seem to center in the top unit. If you can hear the motor running, but the antenna does not move, suspect a stripped pinion, or more likely, a slipping pinion on one of the gears in the train. Now and then the pinion becomes loose on its shaft, which will cause the whole train to slip and lose power. Replacement is the best cure; however, in an emergency, the loose pinion may be soldered or brazed to the shaft. As a result of extremely rough treatment, the stops may be broken off the ring gear which drives the top assembly. This goes all the way around the base. If this occurs, the rotator will continue to turn, breaking the lead-in wire. A temporary stop might be made by drilling and tapping a hole in the housing and inserting a short heavy bolt.

The eight wires in the control cable are fairly small and flexible, due to the small current demand of the unit, and may be broken by rough handling or careless installation. The rotator cable should be taped firmly to the mast all the way down, at least every 24 inches, using a good grade of plastic electrical tape. Common friction tape will weather away within a month or two, so use the best. Fasten securely to the roof and eaves, using insulated staples, to avoid whipping in the wind.

If the customer desires a portable installation, the rotator cable may be taken underneath the floor, and brought up to an ordinary octal socket, mounted in a hole in the floor behind the TV set. More wires may be run from this socket in parallel, to other sockets installed wherever desired. A six-foot piece of cable is then connected to the control box, terminated in an octal plug of the cable-type, as used in p.a. work. The control box may then be plugged in wherever needed.

One other major type of rotator is the "automatic" type. Although the motor and gearing is about the same as described previously, the direction switch uses an arrangement similar to that used in the automatic tuning radios of a few years ago. The selector knob is set to South, for instance. Through a ring contact on this switch, current is supplied to the motor, which

turns the antenna in the desired direction until the slider reaches a gap in the ring contact, breaking the circuit. At the same time, a stepper solenoid moves the indicating pointer, or possibly a traveling pilot light, across the dial, so that the light shows the actual position of the antenna itself at all times.

Troubles that arise are due to defective wiring, open or leaky motor capacitors, and dirt on the switches. If the motor refuses to stop, check the gap in the ring contact. Dirt and grease may have caused a short across the gap, so that the slider jumps it and keeps moving. A four-conductor cable, which greatly resembles the familiar 300-ohm twin-lead, is used. For identification, one outside wire is tinned, or silver colored, the rest being plain copper. This tinned wire is commonly used as No. 1, the others following in order across the cable.

Position indicators on some early models were quite novel, indeed. One, when opened, disclosed what appeared to be a common automotive-type gasoline gauge, the unit which is found in the fuel tank. This is connected to a meter-type indicator in the control box, power for this arrangement being supplied by a 6-volt winding on the transformer and a selenium rectifier with filter. The actuating arm of the "tank unit" is connected through appropriate linkage, to the rotator head. When this is turned, the movement is translated into a voltage reading on the meter below. Instead of reading "half full," you now read "North!"

Later models of the same basic type use a wirewound potentiometer, 200-300 ohms, with a linear taper, which is mounted on the rotating part of the head, with the slider on the stationary part. See Fig. 5. A small a.c. voltage is fed to this pot, and the voltage read on a small a.c. voltmeter in the control box, calibrated in directions instead of volts.

Another type of rotator using a similar direction indicator, but a slightly different gearing and drive, is shown in Fig. 6.

By observing the points mentioned, as to servicing and installation practices, you can build a local reputation as a rotator expert—one that may well pay off.

—30—

Fig. 6. This Vee-D-X model AR rotator uses a four-wire cable and an in-line drive.



International Short-Wave

(Continued from page 74)

0300 closedown over 9.705, and parallel over OTC, 9.655, Leopoldville, Belgian Congo. (McGraw, Ohio, many others) Brussels also uses 6.085 in this beam. (Peterson, Texas, others)

Bolivia—CP38, 9.438A, noted closing 0230A after religious program in Spanish. (Cox, Dela.)

Brazil—German SWL's report the new Catholic station on 9.625A around 2030; has "Angelus" broadcast 2100; identifies as "Emissora Catolica do Radio Caravita"; also may take relay of "A Voz do Brazil" (news in Portuguese) 2230-2300. (ISWC, England) Heard in Ind. around 2300. (Niblack) PRL7, 9.720, Rio de Janeiro, is good level in Sweden from 2100 onwards. (Stenson)

British Honduras—Radio Belize, 3,300, noted with music 0100-0200, only slight QRM. (Swenson, Minn.) Lists 3.3, 4.9, 6.1 daily 1800-1900, 0000-0300. (Weaver, Va.)

Bulgaria—Radio Sofia noted on 7.671A parallel 7.255A with English 2030-2100, 2145-2215A (Pearce, England) Heard on 6.070 with English for North America 0030. (Southwestern SW Club, Dallas, Texas)

Burma—"The Voice of Burma," 4.774A, Rangoon, noted with English 1445, bad CWQRM, fair level. (Welder, Sweden; Sutton, Ohio) Heard in Japan on 9.535A at 1415-1515 closedown. (JSWC)

Canada—CFVP, 6.030, Calgary, Alta., poor level 1530-1600; verified. (McDaniel, Idaho) Has newscasts (5 min.) at 2300, 1500. (Callarman, Ore.) CHU, 7.335, Dominion Observatory, Ottawa, Ont., now has time announcements in voice. (Kippel, Colo., others) Announces EST (add 5 hours for GMT) every minute; heard over 3.330A outlet. (Scheiner, N. J.) Note VE9AI, 9.540, Edmonton, Alta., fading in around 1500 (Stark, Texas)

Canary Islands—EA8AB, measured 7.505, Tenerife, noted 2229 in Spanish. (Ferguson, N. C.)

Cape Verde Islands—Praia lately uses 3.925A parallel 7.397 at 2000-2200 closedown. (WRH, others)

Chile—CE1515, 15.150, Santiago, good level 2013, Spanish, recordings. (Ferguson, N. C.)

China—Radio Peking, 11.960, good level in Idaho with news 0300-0330. (McDaniel) Best signal from Radio Peking recently has been over the 11.300 outlet; try in the 2230-0130 beam (no English), should have (English) news 0300, 0900, 1430. Morgan, Calif., notes the China Press Agency, Peking, now on 15.425, 14.465, 13.800, opening usually 0000 with dictation-speed news in Chinese.

Colombia—Accion Cultural Popular, 5.075, Sutatenza, uses a General Electric 25 kw. transmitter 0950-1215, 2050-2230. (DX-Radio, Sweden)

Cook Islands—According to Cushen, N. Z., Rarotonga, 6.180, operates currently Thur. 0430-0500, and Wed., and Fri. 0200-0300. (DX-Radio, Sweden)

Costa Rica—DX-Radio, Sweden, lists TIRF, 11.972, Radio Popular, San Jose, 1200-0400. Dorothy Sanderson, Australia, reports excellent reception of TIFC, 9.647, San Jose, during Ken Boord's organ recital in special DX broadcast at 0500-0530 on Dec. 25. Was also heard well in many other parts of the world.

Cuba—Havana, 9.532A noted around 0000, good level, Spanish. (O'Brien, N. Y.) Former channel of COCW, 6.310, is now occupied by Radio Continental, heard best in Germany 2100-2400. (ISWC, England) Radio Alvarez, COBX, Havana, has been logged on 12.000V at 2100; all-Spanish. (DX-Radio, Sweden) COKG, 8.955A, completely in clear 2330 with Spanish program. (Swenson, Minn.)

Cyprus—ZJMS, 9.650, Limassol, heard by Hardwick, N. Z., at 1715 with English Lesson. (ISWL, England) Noted over channels of 6.120, 6.790 to past 0500 with Arabic talk and music; 6.120 best in N. H. (Hill)

Czechoslovakia—Prague, 7.255, noted with English 1900-1930; and opening in English 1215 on 9.504, news, talks, interspersed with musical selections to end of English session 1241A. (Pearce, England) Heard with English to North America 0030-0100 over 9.550, 7.255. (Grant, Mass., others)

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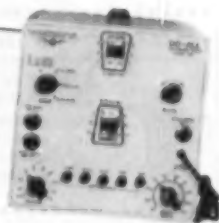
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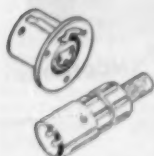
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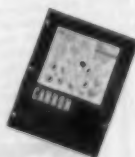


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Dominican Republic—HIIR, 6.176A, "La Voz de Fundacion," San Cristobal, which normally closes 0100A, at least weekdays, noted running as late as 0310 on a Monday (Sunday in San Cristobal). (Niblack, Ind.) HI2T, 9.735, noted one day ending *English-Spanish Lesson* ("English By Radio") at 0150. (Foster, Ill.)

Dutch New Guinea—Nattugglan, Sweden, says *Radio Hollandia* is heard on 3.390 at 1000.

Ecuador—HCJB, Quito, lists *English* for North America on 15.115, 11.915, 9.745 at 0200-0500, except Tue. (Argue, Ohio)

El Salvador—"Mil Veinticinco, Ondas Populares," 6.075, good level around 0445; all-Spanish. (Foster, Ill.)

England—BBC, 5.990A, heard QSA5, S9-plus 20 db from 0130-0200 with musical comedy. (del Pozo, Cuba)

Ethiopia—Radio Addis Ababa, 15.342A, has *English* around 1900-1930 closedown. (DX-Radio, Sweden)

Fiji Islands—VRH4, 3.980, Suva, heard 0915 with news, music. (Sander-son, Australia)

Finland—OIX4, 15.190, Helsinki, noted 0945 with news. (Pearce, England) Has *English* for North America 1100-1115 (weekdays); no *English Sun*. (Grant, Mass.) Uses OIX5, 17.800, in parallel.

France—Paris, 6.200, strong 0605-0610 in foreign language. (Machajewski, N. Y.) Heard well on 17.850, parallel 15.100, to Canada 1530-1545; noted closing with "La Marseillaise" and interval signal on 15.240 at 1100. (Morris, Ohio) Heard on 17.850 at 1411, fair level, but with QSB. (Foster, Ill.) Noted on 9.550A at 0534 at excellent level in French. (Chamberlayne, Va.)

French Equatorial Africa—Radio Brazzaville, 11.970, noted with news 1850, slight QSB. (Dresser, N. Y.)

French West Africa—Radio Dakar, 4.890, 4.950, audible after 0230, with French news to 0800 sign-off; the 9.560 channel is inaudible except Sun., but is heard after 0800 to 1100 or later. (Balbi, Calif.)

Germany—NWDR, Hamburg, now has regular test transmissions on 3.970 at 0500-0100 (relaying European Service from m.w.) and 0130-0430 (relaying "Deutsche Welle," Overseas Service, Cologne, in beam to North America). (Pearce, England; WRH, others) Appreciates reports and "all those that are correct and useful are verified by QSL card." (ISWC, England) Cologne logged on 5.980 during *English* 0422. (Schwartz, D.C.) Good level on 7.290 at 0400. (Mast, N.Y.) Baden-Baden, 7.265, noted 1045 with news in German. *Bayerischer Rundfunk*, Munich, sent QSL card and listed schedule of Mon., Wed., Fri., 0430-0850, 0930-2400; Tue., Thur., Sat. 0430-2400; Sun. 0500-2400; frequency is 6.160. (Pearce, England) AFN, 3.188, Bayreuth, noted in Sweden 1830-1930. (Nattugglan)

Gilbert Islands—Radio Tarawa, 6.050 now radiates Sat. only at 0200-0230 in Gilbertese, but will expand transmissions soon. (DX-Radio, Sweden, others)

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RADIO & TELEVISION NEWS

Gold Coast—ZOY, 4.915, Accra, noted from 1730; news 1745, closed 1800; CWQRM. (URDXC)

Greece—Radio Epiros, Janina, 7.080, relays VOA, Salonika, at 2030-2045; closes 2130 with anthem. (Austrian DX-Club) **Radio Athens**, 9.607, noted 0711 with interval signal, opening with call in Greek 0714, then with Greek music and songs. (Pearce, England) **Forces Station**, 7.420, Athens, noted with native singing 1820, announcements in Greek by woman; fair level in Dela. (Cox)

Greenland—OZL, 7.570, Angmagssalik, noted with Greenlandic 1430-1455; good strength in Sweden, but with QRN, CWQRM. (Welder) However, **Nattugglan**, Sweden, lists this one at 1400-1450. DX-Radio, Sweden, quotes **WRH** that the **Armed Forces Radio Service** (USA Military) at Thule Airport operates with 1 kw. on 4.425; further details requested.

Guatemala—TGWA, 9.764A, heard 0200 at good level with music. (Meyer, N.Y.) TGQA, 6.405, Quezaltenango, noted 0120-0200A; CWQRM heavy. (Mulligan, N.Y.) TGNB, 9.668, is good level 2300 in English. (Hermann, N.Y.)

Haiti—4VHW, **Radio Haiti**, Port-au-Prince, recently moved from 5.840 to 6.216A; is usually perceptible around 2130, and is very good strength by 0100, but suffers QRM from CE622, Chile; frequency varies a little; announces, "Ici Radio Haiti, postes 4VW, 4VRW et 4VHW a Port-au-Prince." The 4VRW outlet has been silent for several months, reportedly due to fire damage. (**Nattugglan**, Sweden, others) Has English ("Musical Caravan" session) Fri. 0315-0330. (Swenson, Minn., others) 4VC, 9.485, **Radio Commerce**, good level around 1330 in French. (Mainwaring, N.Y.) 4VEH, 9.640 (measured by Ferguson, N.C., at press time), noted Sat. 1430-1500 with "Mailbag" session. (Brown, Ohio)

Honduras—HRXW, 6.110, Comayagua, noted 1215 in Spanish; good level in N.C. (Ferguson)

Hong-Kong—ZBW3, 9.525, Victoria, has English 1535-1600A. (JSWC)

Hungary—Radio Budapest, 9.833A, noted 0400 with news to North America. (Riggle, Ohio) And at 0030-0100, S7, R4 in Mo. (Wilcox) Noted with English 2000-2030 over 6.248. (Pearce, England) Good signal then in West Virginia. (Boord)

Iceland—TFJ, 12.175, noted Sun. only 1615-1639 in Icelandic; some CWQRM. (Saylor, Va., others)

India—AIR, 3.365, Delhi, noted at S8 level with BBC rebroadcast in English 1545; noted on measured 3.945 (formerly on 3.950) with news 1530, parallel with measured 3.990; VUM2, 4.920, Madras, logged 1525 with Indian music (but different from that on 4.760 channel); at 1530 had news. (Fairs, England, via URDXC) Calcutta, 3.305, noted in Japan 1220; on 4.880 at 1220, R5, S7 with news at 1230. (JSWC) Delhi has good level at Eastern USA in English beam to Southeast Asia 1330-1445; 11.640 (or 11.605) should parallel.

Indo-China—Radio France-Asie, Sai-



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gon, now has *English* 0130-0145, 1400-1415 over 9.775A. (Buettner, Germany, via ISWC, England) Heard on 15.420 with *English* program of news, music at 1000. (Sanderson, Australia) At last check, had *English* for Europe at 1600 over 6.115 (replacing 11.790). (Balbi, Calif.)

Radio Hue, 7.205, South Vietnam, heard in Japan 1320 in French, R5, S5. An unidentified Vietnamese station opens on 9.475A (heard once on 9.495A) around 1000-1035 daily; "The Voice of the Vietnamese National Army" (a program of "The Voice of Free Vietnam") is heard on *Sun., Tue., Thur.* at 1215-1230 on 7.260A. "Voice of Free Vietnam," 9.625, Saigon, opens 0925, and has *English* 1340-1400 sign-off. (JSWC)

Iraq—Radio Baghdad, 3.297A heard in *English* 1915-2000 closedown, good strength but with QRN, CWQRM. (Welandar, Sweden) Heard over the "Overseas" channel of 11.702A at 0543 with Arabic chanting, man in native; S7 with slight QSB in Dela. (Cox)

Israel—4XB44, 6.725, *Galei Zahal*, heard with music 1900, announcements in Hebrew; good strength, sometimes has CWQRM. (Welandar, Sweden) Tel Aviv, 9.008, good level with *English* ("Voice of Zion") session 2115-2200 or later. (Machajewski, N.Y., others)

Italy—Palermo has moved from 6.260 to 7.175. (ISWL, England; Mercier, France) Fairs, England, reports Rome's National Program on new measured 7.175 around 2000, parallel with 6.240. (URDXC) Heard on 7.290 opening to Britain in *English* 1830; Home Service, 9.420, heard 1535 with songs, popular musicals, announcements in Italian. (Pearce, England) Rome, 9.570A, noted with *English* to North America 0015-0035, then with French. (Scott, Ga.)

Ivory Coast—QSL card from *Radio Abidjan* depicts native boy on a microphone with elephants, palm trees in background. (Pearce, England) Listed 4.945 with 5 kw. (Cox, Dela.) Heard some days fairly well 0700 with French news, closing 0730A. (Balbi, Calif.) Heard best in Ohio 2100-2130 closedown. (Sutton)

Japan—Far East Network (AFRS), 6.160, Tokyo, noted with popular music 1055, fair level in Colo. (Kippel) JOZ, 3.925, Tokyo, commercial outlet, heard at high level 0900 in Japanese; uses three pips, long tone at station break time; ham QRM bad (Callarman, Ore.) JOA4, 11.705, *Radio Japan*, Tokyo, noted in South American beam when checked 2315-2330; good level in Ind. (Niblack) News heard on the 9.695 channel when tuned 1247, strong level in Dela. (Cox)

Kashmir—Radio Kashmir, 5.030, noted in Sweden 1345-1400 sign-off; QSA/K 2-3 with news and music in native. (Eteravep)

Kenya Colony—Nairobi sends on 3.315 with 2.5 kw. in *English* 1830-2000, in Hindustani 1545-1830. (Nattugglan, Sweden) The 4.885 outlet is scheduled *Mon.-Fri.* 1000-1100, 1500-2000; *Sat.* 1000-1110, 1500-2000; *Sun.*

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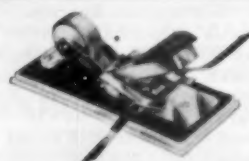
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RADIO & TELEVISION NEWS

0700-1100, 150-1900. (ISWC, England)

Lebanon—Radio Beirut, 8.036, noted 1815-1830 with news in French. (de Mesquita e Sousa, Portugal) With English session 1500-1600, closing this with "The Knightsbridge March." (Pearce, England)

Liberia—ELBC, 6.022A, Monrovia, fair level 2300, heavy QRM most of the time; VOA rebroadcast. (Saylor, Va.) Closedown time is 2345.

Libya—"Forces Broadcasting Service, North Africa", 3.305, Benghazi, noted opening 1630 and closing 2100; re-opens 0400 over 7.220. (Pearce, England) Has BBC news relay 1700 and at other times.

Luxembourg—Radio Luxembourg, 6.090, noted with news in French 1200. (Pearce, England) Some days is powerful level around 0600 with popular recordings. (Niblack, Ind.) Noted on Sun. with English 2230 which lasted to 2400 when closed with National Anthem; very good level; played popular recordings, interspersed with commercial announcements; woman, man announcers; asked for reports from anywhere. (Saylor, Va.)

Madagascar—Radio Tananarive, 9.515, noted 0330 with music, announcements in French. (Riggle, Ohio) Heard 1715 with dance music, call by woman in French 1717, closed 1930 with "La Marseillaise." (Pearce, England; Cox, Dela.)

Malaya—BFESB, 11.820, Singapore, noted in English 1200; relays BBC news 1300. (Kellogg, La.) Good level in Sweden over 11.955 at 1400 when relays "Radio Newsreel" from the BBC. (Stenson) Heard on 15.425 at 1015 with music and news. **Radio Malaya's Blue Network**, 4.820, Singapore, noted 1130 with news, music. (Sanderson, Australia) Kuala Lumpur, 6.025, should parallel.

Mexico—QRA for XESC, "Las mas espanola del Mundo," 15.205, is Aparado 22717, Mexico 8, Mexico. (Nattuglan, Sweden)

Mozambique—WRH says a new religious station is "Radio Pax" (Emissora Catolica da Beira) at Beira, 3.100A and 7.205A; further details desired. Welandar, Sweden, notes **Radio Clube de Mozambique**, 4.870A, Lourenco Marques, with musical program, announcements in Portuguese, at 2000; good signal. CR7BU, 4.92V, noted by Kapp, Calif., opening 0400 with popular request session in English, fair level.

New Caledonia—Radio Noumea, 3.375, noted 1000 with French news, music. (Sanderson, Australia)

New Zealand—Tests from a station of the N.Z. Post Office, 8.775A, noted 0620 at good level. (Johnson, Mich.) ZL3, 11.780, Wellington, heard at good level 2100 with man giving weather report. (Cox, Dela.) ZL18, 9.520, noted 1024-1040. (Machajewski, N.Y.)

Nicaragua—New YNV, Managua, **Radio Nacional**, noted on 11.810A between 0300-0500 or later. (Sutton, Ohio)

Nigeria—Current schedule for the Nigerian Broadcasting System includes



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North Borneo—Radio Sabah, VS4S, 7.237, has been heard in Sweden with English 2000-2045. (DX-Radio)

Northern Rhodesia—Lusaka, 4.826, heard in Sweden 1800 with BBC news relay. (Etersvep) On 7.220 (at times may use 7.120 instead) is heard in Japan 1500-1620, time signal 1600. (JSWC)

Norway—Radio Norway, 7.210, noted 0400-04330. (del Pozo, Cuba) LLS, 7.210, Tromsø, heard 1540 with Home Service, popular music. (Pearce, England)

Okinawa—AFRS, 4.100, Okinawa, noted in Japan 0930, QSA3, heavy QRN; noted also 0945-1000 with popular songs. (JSWC) Sanderson, Australia, lists this one on 4.090, heard 1100 with variety show, then news, music.

Pakistan—Radio Pakistan, 17.750, Karachi, has news 1200-1210. (Austrian DX-Club) Noted opening 1245 on 15.135 for Indonesia with native music and songs; has English ("Pakistan Calling" series) 1300, closes 1330; slow-speed news noted 1740-1800 over 7.010, 6.235. (Pearce, England) Good level on these last-named channels (6.265 is best) at 2015 with "Pakistan Calling" (English) in beam to United Kingdom. (Cox, Dela.) Heard with news 0100 over 11.885. (Sanderson, Australia)

Paraguay—ZPA5, Radio Encarnacion, 11.945, noted 2200 with news in Spanish; QRK54 without QRM in Portugal. (de Mesquita e Sousa) ZPA3, Radio Teleco, 11.850, noted in Sweden 2203-2300. (Etersvep)

Peru—OAX6E, Radio Continental, 6.336, Arequipa, heard in Sweden 0445-0503 sign-off. (Nattugglan) OAX4K, Radio Central, 9.540A, Lima, good level in Germany 2100-0500. (ISWC, England)

Philippines—DZB2, 3.345, "Voice of the Orient," FEBC, Manila, heard in Britain from 2210 onwards, S4-6, CWQRM. (ISWL, England) DZH3, 9.500, Manila, noted 1030 with news, music. (Sanderson, Australia) DZH6, 6.030, Manila, heard with news 1400 by woman. (Morgan, Calif.)

Poland—Radio Warsaw, 6.025, noted at poor to fair strength 0230-0300 for North America in English, heavy QRM. (Churchill, Va.) Heard with English on this channel at 0545; noted on 5.995 at 2235 with English. (Schelner, N. J.)

Portugal—Lisbon, 6.380A, noted 2235 at good level, CWQRM. (O'Brien, N. Y.) CSA28, 9.775, Lisbon, heard 2330 in Portuguese, excellent level; closed on this channel 2400. (Morgan, Calif.) CSB51, Radio Clube Portugues, Parede, is well received in Sweden on the new 6.080 channel, from around 2100. (Nattugglan)

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Puerto Rico, 9.995A, heard 0450 with test in *English*, S6 level. (Meyer, N. Y.; Reidler, Pa., others)

Roumania—Bucharest, 9.570, 6.210, noted with *English* 0430-0500. (Rose-ner, Ill.) Also 0300-0330. (Peterson, Texas) *English* noted 1930-2000, audible on 6.210, 9.254, 9.570. (Pearce, Eng-land) Has news 2230-2245 on 9.570. (Saylor, Va.)

Saar—The new broadcasting and television center of the Saar is now under construction at the village of Felsberg, near Saarlautern. (ISWC, England)

Saudi-Arabia—Djeddah has been heard in Japan on 7.100AV (many times on 7.095A instead) signing on 1520, 1610, and 1740 (with last sign-off at 1930A). (JSWC)

Somali—Radio Mogadiscio, 7.075A, is fair level in France to 1800 when closes without playing any anthem; announces "Qui e la Radio Mogadiscio." (Mercier) Has news in Somali 1630, in Italian 1725A. (Radio Sweden; Pearce, England) Usually closes with light music, according to Pearce.

South Africa—SABC, Johannesburg, has been heard in Britain on 11.710 with *English* from 1830 to fadeout 2030; news 1900; weather forecast 1908. (ISWC, England) *Springbok Radio*, commercial, 7.295, Johannesburg, heard in Japan 1545. (JSWC)

South Korea—Seoul, 2.510, heard in Japan 2110 with music, R5, S9. (JSWC) Noted parallel over 7.933A, R9. (Bates, Okinawa)

Southern Rhodesia—Salisbury, 3.320, heard in Sweden 1820-2100 with CWQRM, good recordings. (DX-Radio, Sweden)

Spain—"Transmitte Radio S.E.U." is the slogan of the school transmitter in Madrid, now audible in German on 6.075A when the Technical University transmitter at Istanbul, Turkey, 7.080, closes down 2000. (ISWC, England) Madrid, 9.363AV, excellent in *English* to North America 2300-2340AV. (Winch, Calif.; Scott, Ga., many others)

Surinam—After a short stay on 4.792, Paramaribo is noted on 4.742 as early as 2215 with fair level, although is subject to CWQRM; Dutch news 2330. (La Radio Mondiale, France)

Sweden—Stockholm, 9.535, noted 1500 closing *English* to Southeast Asia, fairly good level in N. Y. (Joel Levy)

Switzerland—Berne, 6.165, strong level opening 0130 in *English* to Eastern North America. (Way, Ohio, others) Home Service, 3.985, Berne, noted 1515 with music. (Pearce, Eng-land)

Syria—Damascus, 9.555, noted 2040 with news in French. (de Mesquita e Sousa, Portugal) Has news for Europe 2145. (Nattugglan, Sweden) *English* session runs 2130-2230 closedown. (ISWC, England)

Tahiti—Radio Tahiti, 7.025, Papeete, noted with news in French 0500-0510, then music. (Sutton, Ohio)

Taiwan (Formosa)—BEC38, 3.370, police broadcasting station, heard daily 0400-0630, 1030-1600, R3, S4 by "day"



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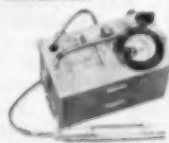
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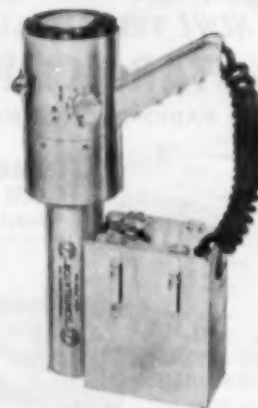
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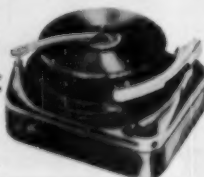
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and R5, S8 by "night," very strong on Okinawa. (JSWC) BED38, 5.960, BED44, 7.040, heard with improved signals from 0900 onwards. (Balbi, Calif.) Current schedule to North America is 0300-0600 over BED4, 11.920. BED6, 11.736; English 0305-0330, 0430-0500. (Callarman, Ore.; Scheiner, N. J.)

Tangier—WTAN, "The Evangelical Voice of Tangier," 7.175, has "Peter and John, the Singing Scotch Evangelists" of Baltimore, Md., USA, daily except Sun. 2200-2230; other English programs are Mon., Wed., Fri. 2030-2100, Tue. 2045-2100, Sat. 2030-2045. Wants reports. (Pearce, England; Stenson, Sweden; others)

Thailand (Siam)—HSK9, 11.670, Bangkok, noted with English 1025-1130, then has news in Malay. (Welandar, Sweden) Has news, weather report 1045. (Sanderson, Australia) Heard in Thai 1300-1400A, when closes down "Overseas Service" but continues on channel (in Thai) with "Home Service" programs. (Pearce, England, others) Heard occasionally in North American beam at 0415-0515, news around 0430A. (Morgan, Calif.)

Turkey—Radio Ankara heard with English for Western Europe and Britain 2100-2145 closedown now over TAS, 7.285, parallel TAP, 9.465. (Reidier, Pa.; Pearce, England, others) Excellent to North America 2315-2400 over TAT, 9.515, English. (Chamberlayne, Va., others)

Uruguay—CXA10, Radio Sodre, 11.900, Montevideo, is scheduled daily 1200-0300 with Spanish sessions. (ISWC, England)

USI—Djakarta has English for Europe 1900-2000 over YDF6, 9.585; also "reported" parallel over YDF2, 11.770. (Hardwick, N. Z., via ISWC, England) Noted during English session 1430-1530 over YDF6, 9.710, Djakarta. (Pearce, England) YDQ, 9.552A, Makassar, Celebes, noted 1248 with native choir singing, woman announcer; clock chimes 1300. YDU, 4.840, Denpasar, heard in Calif. with Indonesian music 1345. (NNRC) Radio Angatan Udara, 11.945A, Djakarta, noted in Japan with popular music to 1130 closedown. (JSWC)

USSR—Achhabad, Turkmenia, 11.678, noted 1510 with man in native, some QRM. (NNRC) Radio Tashkent, 6.825, noted with English for India-Pakistan 1500-1530, and announcing other English session for 1200-1230. (Pearce, England) German Service from Radio Moscow 5.950A, heard 1900-1930 closedown. (Schwartz, D. C.) Moscow is fair level on 5.965 with news 1830, parallel 5.930 (Cox, Dela.)

Vatican—HVJ, 11.685, good to excellent strength 1200-1230. (Churchill, Va.)

Venezuela—Radio Popular, 9.527A, noted to sign-off 2235, announces call of YVMZ. (ISWL, England, others) YVLK, 4.972A, noted in Spanish 2345, slight heterodyne. (Swenson, Minn.) Radio Maracay, 3.310, noted 0245-0300 with popular North American tunes in



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Latin-American instrumental tempo; evidently has moved from 3.430. (Cal-larman, Ore.)

Yugoslavia—Belgrade, 6.100, noted in *English* 2230. (Esser, Pa.) Begins news 2215. (Ferguson, N. C., others) Heard with news, commentary 1830-1845 over 7.200, parallel 6.100. (Pearce, England)

Press Time Flashes

At press time, 4VEH, Haiti was testing on new channel of (announced) 9.639 (measured by Ferguson, N. C., as 9.640) for all broadcasts; by now should have extended broadcasts. (Sayler, Va.; West, Calif.) A recent overseas report that the BBC is verifying its European Service was in error. (ISWC, England) *Radio Maroc*, Rabat, Fr. Morocco, has been "found" on 6.089 at 1830 with musical program; at 1900 Spanish; 1500 Arabic to closedown 2300; may be new transmitter since has powerful level in France. (Mercier)

The Central People's Broadcasting Station (Chinese-Communist) heard in Japan 1230-1300 in parallel with all other Communist-Chinese stations, songs and news in Chinese; signal is R5, S9 in Japan on 3.905A. (JSWC) A new Greek station, located in Athens, is operating on 6.075, audible in France at 1900 at good strength; probably relays a m.w. outlet. (La Radio Mondiale) In addition to the *Sun*, only program in *English* ("Impulses of Haiti") over 4VC, 9.485, *Radio Commerce*, Haiti, now has *English* also on Thur. 0300-0315 over 4VB, 6.091. (Russell, Calif.; Niblack, Ind., others) *Radio Brazzaville* is fair level on new 9.625 around 0015. (Niblack, Ind.)

TGWA, 9.760, Guatemala City, noted on a *Sat.* with *English* from 0530; told about people, climate, industries, and so on; at end of *English* session asked for reports to National Broadcasting Station, Guatemala City, Guatemala. (Shear, Ia.) Lists schedule for TGWA, 9.760A, and TGWB, 6.180, as *weekdays* 1225-0600, *Sun*, 1355-0500. (Pearce, England)

WRH recently listed several USSR channels other than those of *Radio Moscow*, including Kiev, 6.020, 9.271, 9.593, 9.670, 9.804, 11.720, 11.785 (all 40 kw.); Komsomolsk, 6.055, 6.115, 9.565, 9.725, 11.750, 15.230 (all 50 kw.); Krasnoyarsk, 5.910; Leningrad, 7.340, 9.600, 9.750, 11.630, 11.885, 15.055; Magadan, 3.970, 5.830, 6.067, 11.690; Molotov, 5.485; Alma Ata, 5.860, 5.900, 6.220, 9.250, 9.340, 9.380, 9.451, 15.000 (all 15 kw.); Ashkabad, 6.179, 9.600, 9.680, 11.839 (all 15 kw.); Baku, 4.958, 6.195, 9.840 (all 2 kw.); Blagoveshchensk (Ajur Region), 4.956 (1 kw.); Bukhara, 6.072; Chimkent, 4.310; Dzhambul, 5.310; Frunze, 4.049, 5.060 (both 1 kw.); Gorno Altaysk, 9.310 (1 kw.); Guryev, 5.150 (1 kw.); Kaunas, 9.685; Khabarovsk, 4.273, 4.581, 5.940, 6.019, 6.149, 8.820, 9.378, 9.669, 11.800, 15.180 (all 20 kw.).

In verifying, Prague listed *English* for Europe-Britain 1215-1245, 9.504; 1900-1930, 7.255; 2300-2330, 6.115.

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12C8	.15	12A2	.15	6X10	.15
12D1	.15	12A3	.15	6X11	.15
12D2	.15	12A4	.15	6X12	.15
12D3	.15	12A5	.15	6X13	.15
12D4	.15	12A6	.15	6X14	.15
12D5	.15	12A7	.15	6X15	.15
12D6	.15	12A8	.15	6X16	.15
12D7	.15	12A9	.15	6X17	.15
12D8	.15	12A10	.15	6X18	.15
12D9	.15	12A11	.15	6X19	.15
12D10	.15	12A12	.15	6X20	.15
12D11	.15	12A13	.15	6X21	.15
12D12	.15	12A14	.15	6X22	.15
12D13	.15	12A15	.15	6X23	.15
12D14	.15	12A16	.15	6X24	.15
12D15	.15	12A17	.15	6X25	.15
12D16	.15	12A18	.15	6X26	.15
12D17	.15	12A19	.15	6X27	.15
12D18	.15	12A20	.15	6X28	.15
12D19	.15	12A21	.15	6X29	.15
12D20	.15	12A22	.15	6X30	.15
12D21	.15	12A23	.15	6X31	.15
12D22	.15	12A24	.15	6X32	.15
12D23	.15	12A25	.15	6X33	.15
12D24	.15	12A26	.15	6X34	.15
12D25	.15	12A27	.15	6X35	.15
12D26	.15	12A28	.15	6X36	.15
12D27	.15	12A29	.15	6X37	.15
12D28	.15	12A30	.15	6X38	.15
12D29	.15	12A31	.15	6X39	.15
12D30	.15	12A32	.15	6X40	.15
12D31	.15	12A33	.15	6X41	.15
12D32	.15	12A34	.15	6X42	.15
12D33	.15	12A35	.15	6X43	.15
12D34	.15	12A36	.15	6X44	.15
12D35	.15	12A37	.15	6X45	.15
12D36	.15	12A38	.15	6X46	.15
12D37	.15	12A39	.15	6X47	.15
12D38	.15	12A40	.15	6X48	.15
12D39	.15	12A41	.15	6X49	.15
12D40	.15	12A42	.15	6X50	.15
12D41	.15	12A43	.15	6X51	.15
12D42	.15	12A44	.15	6X52	.15
12D43	.15	12A45	.15	6X53	.15
12D44	.15	12A46	.15	6X54	.15
12D45	.15	12A47	.15	6X55	.15
12D46	.15	12A48	.15	6X56	.15
12D47	.15	12A49	.15	6X57	.15
12D48	.15	12A50	.15	6X58	.15
12D49	.15	12A51	.15	6X59	.15
12D50	.15	12A52	.15	6X60	.15
12D51	.15	12A53	.15	6X61	.15
12D52	.15	12A54	.15	6X62	.15
12D53	.15	12A55	.15	6X63	.15
12D54	.15	12A56	.15	6X64	.15
12D55	.15	12A57	.15	6X65	.15
12D56	.15	12A58	.15	6X66	.15
12D57	.15	12A59	.15	6X67	.15
12D58	.15	12A60	.15	6X68	.15
12D59	.15	12A61	.15	6X69	.15
12D60	.15	12A62	.15	6X70	.15
12D61	.15	12A63	.15	6X71	.15
12D62	.15	12A64	.15	6X72	.15
12D63	.15	12A65	.15	6X73	.15
12D64	.15	12A66	.15	6X74	.15
12D65	.15	12A67	.15	6X75	.15
12D66	.15	12A68	.15	6X76	.15
12D67	.15	12A69	.15	6X77	.15
12D68	.15	12A70	.15	6X78	.15
12D69	.15	12A71	.15	6X79	.15
12D70	.15	12A72	.15	6X80	.15
12D71	.15	12A73	.15	6X81	.15
12D72	.15	12A74	.15	6X82	.15
12D73	.15	12A75	.15	6X83	.15
12D74	.15	12A76	.15	6X84	.15
12D75	.15	12A77	.15	6X85	.15
12D76	.15	12A78	.15	6X86	.15
12D77	.15	12A79	.15	6X87	.15
12D78	.15	12A80	.15	6X88	.15
12D79	.15	12A81	.15	6X89	.15
12D80	.15	12A82	.15	6X90	.15
12D81	.15	12A83	.15	6X91	.15
12D82	.15	12A84	.15	6X92	.15
12D83	.15	12A85	.15	6X93	.15
12D84	.15	12A86	.15	6X94	.15
12D85	.15	12A87	.15	6X95	.15
12D86	.15	12A88	.15	6X96	.15
12D87	.15	12A89	.15	6X97	.15
12D88	.15	12A90	.15	6X98	.15
12D89	.15	12A91	.15	6X99	.15
12D90	.15	12A92	.15	6X100	.15
12D91	.15	12A93	.15	6X101	.15
12D92	.15	12A94	.15	6X102	.15
12D93	.15	12A95	.15	6X103	.15
12D94	.15	12A96	.15	6X104	.15
12D95	.15	12A97	.15	6X105	.15
12D96	.15	12A98	.15	6X106	.15
12D97	.15	12A99	.15	6X107	.15
12D98	.15	12A100	.15	6X108	.15
12D99	.15	12A101	.15	6X109	.15
12D100	.15	12A102	.15	6X110	.15
12D101	.15	12A103	.15	6X111	.15
12D102	.15	12A104	.15	6X112	.15
12D103	.15	12A105	.15	6X113	.15
12D104	.15	12A106	.15	6X114	.15
12D105	.15	12A107	.15	6X115	.15
12D106	.15	12A108	.15	6X116	.15
12D107	.15	12A109	.15	6X117	.15
12D108	.15	12A110	.15	6X118	.15
12D109	.15	12A111	.15	6X119	.15
12D110	.15	12A112	.15	6X120	.15
12D111	.15	12A113	.15	6X121	.15
12D112	.15	12A114	.15	6X122	.15
12D113	.15	12A115	.15	6X123	.15
12D114	.15	12A116	.15	6X124	.15
12D115	.15	12A117	.15	6X125	.15
12D116	.15	12A118	.15	6X126	.15
12D117	.15	12A119	.15	6X127	.15
12D118	.15	12A120	.15	6X128	.15
12D119	.15	12A121	.15	6X129	.15
12D120	.15	12A122	.15	6X130	.15
12D121	.15	12A123	.15	6X131	.15
12D122	.15	12A124	.15	6X132	.15
12D123	.15	12A125	.15	6X133	.15
12D124	.15	12A126	.15	6X134	.15
12D125	.15	12A127	.15	6X135	.15
12D126	.15	12A128	.15	6X136	.15
12D127	.15	12A129	.15	6X137	.15
12D128	.15	12A130	.15	6X138	.15
12D129	.15	12A131	.15	6X139	.15
12D130	.15	12A132	.15	6X140	.15
12D131	.15	12A133	.15	6X141	.15
12D132	.15	12A134	.15	6X142	.15
12D133	.15	12A135	.15	6X143	.15
12D134	.15	12A136	.15	6X144	.15
12D135	.15	12A137	.15	6X145	.15
12D136	.15	12A138	.15	6X146	.15
12D137	.15	12A139	.15	6X147	.15
12D138	.15	12A140	.15	6X148	.15
12D139	.15	12A141	.15	6X149	.15
12D140	.15	12A142	.15	6X150	.15
12D141	.15	12A143	.15	6X151	.15
12D142	.15	12A144	.15	6X152	.15
12D143	.15	12A145	.15	6X153	.15
12D144	.15	12A146	.15	6X154	.15
12D145	.15	12A147	.15	6X155	.15
12D146	.15	12A148	.15	6X156	.15
12D147	.15	12A149	.15	6X157	.15
12D148	.15	12A150	.15	6X158	.15
12D149	.15	12A151	.15	6X159	.15
12D150	.15	12A152	.15	6X160	.15
12D151	.15	12A153	.15	6X161	.15
12D152	.15	12A154	.15	6X162	.15
12D153	.15	12A155	.15	6X163	.15
12D154	.15	12A156	.15	6X164	.15
12D155	.15	12A157	.15	6X165	.15
12D156	.15	12A158	.15	6X166	.15
12D157	.15	12A159	.15	6X167	.15
12D158	.15	12A160	.15	6X168	.15
12D159	.15	12A161	.15	6X169	.15
12D160	.15	12A162	.15	6X170	.15
12D161	.15	12A163	.15	6X171	.15
12D162	.15	12A164	.15	6X172	.15
12D163	.15	12A165	.15	6X173	.15
12D164	.15	12A166	.15	6X174	.15
12D165	.15	12A167	.15	6X175	.15
12D166	.15	12A168	.15	6X176	.15
12D167	.15	12A169	.15	6X177	.15

New TV Circuits

(Continued from page 62)

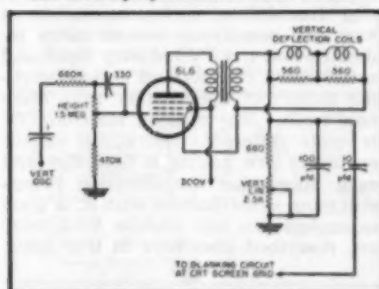
pentodes were used as vertical output amplifiers. An example of this was the use of the 6K6 in 630 sets. In all instances, however, these tubes were used as triodes in order to get good linearity. Now, the pentode amplifier has been modified so that the advantages of gain and power output of the pentode are maintained with sufficiently good linearity. The major application of this system is in low cost receivers using a single half-wave rectifier for the low-voltage power supply therefore operating on only +130 volts. By using a pentode, the vertical deflection coils can be driven sufficiently even for a 21-inch picture tube. This same performance could only have been obtained with special triodes, connected in parallel.

The circuit shown in Fig. 2 is used in the RCA KCS89A and similar models and employs a 6AQ5 tube. Other RCA models use 6K6 tubes, and other manufacturers employ a variety of pentodes including the 6W6, 25L6, etc., in similar circuits. For the circuit in Fig. 2, the "B+" is about 300 volts, but in the new Emerson and Muntz models, the pentode vertical sweep output tube operates from the 130 v. "B+."

In examining the circuit of Fig. 2 we find that the plate of the vertical oscillator supplies a saw-tooth signal to the grid as well as the plate of the output amplifier, the 6AQ5. In other words, negative feedback is used here to improve the linearity of the pentode amplifier. Neither the height nor the vertical linearity controls are novel, but the R-C combination going from the plate of the 6J5 oscillator to the 6AQ5 plate and cathode merit some study. Note that the cathode is bypassed by a 50 μ f. capacitor, but a small 60-cycle signal will appear at the cathode due to the 150,000 ohm resistor and .1 μ f. capacitor.

The waveshape appearing at the plate will be integrated and will not be the same saw-tooth signal as the grid receives. The effect of this is to vary the plate voltage at the same time the grid signal varies in such a manner as to overcome the nonlinear plate current characteristic of the pentode.

Fig. 3. Vertical deflection output circuit used by Sylvania in its model 386B.



March, 1955

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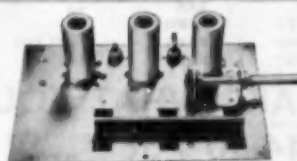
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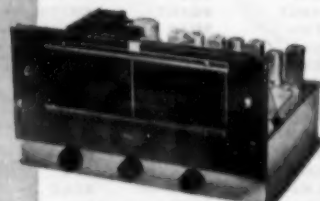
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1H5GT	6AG5	6CB6	6V6GT	12BK7GT	47
1H6GT	6AK5	6CD6G	6W4GT	12SL7GT	50L6GT
1L4	6AL5	6D6	6W6GT	12SN7GT	56
1LC5	6AQ6	6D8G	6X5GT	12SQ7GT	57
1LC6	6AT6	6F6	7E6	12X3	58
1LH4	6AU6	6G8G	7E7	14X7	79L7GT
1LN5	6AV6	6J6	7N7	24A	78
1NSGT	6AW6	6KG7	12AT7	25BQ6GT	89
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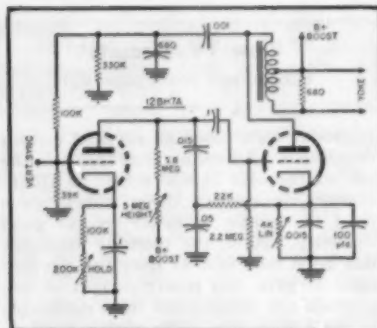
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Some other receivers avoid using any feedback but, instead, use a very special output transformer which helps linearize the sweep. An example of this is shown in Fig. 3 where a 6L6 is used as a pentode with some cathode feedback provided in the vertical output transformer. It is possible by using high current tubes, such as the 6L6, and such special output transformers, to operate the pentode on a sufficiently linear portion of its characteristic.

Still another circuit employing a pentode is used in the new *Muntz* receivers. Here the pentode output amplifier also doubles as the oscillator. A 25L6 is used in this circuit which is reminiscent of earlier *Muntz* models in its economy.

Good stable performance is claimed for the new vertical oscillator-output amplifier system shown in Fig. 4 and used in the latest economy model of CBS-Columbia. A dual triode is used in a combination multivibrator and output amplifier. Feedback from the output to the oscillator input and feedback from the oscillator plate to the output cathode yields good stability and maintains a linear sweep output.

More and more manufacturers are adopting the new 90 degree deflection picture tube which permits a shorter chassis. In addition, many of the picture tubes used are aluminized.

Selenium rectifiers will again be used by *Emerson* after a long absence, and are being abandoned by *Philco* also after long use.

Some other novel circuit features may be coming up during the course of 1955, but at the time this article was written the major emphasis in TV receiver design is on manufacturing economies, parts and circuit reliability, and troublefree performance. In a way, the paucity of new circuitry indicates that the TV industry has found satisfactory circuits and is now working to perfect them rather than blaze new trails. The outlook for color TV is quite different. Here the circuit engineers are having a field day and each successive simplification brings still more simplification with it. A good example is the new 28-tube RCA color set, described elsewhere in this issue.

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(Continued from page 67)

welded (see Fig. 3), causing a short. This will result in a blown fuse.

3. If the set is rated at about 8 amperes and drains 10 or more amperes, the buffer, or timing, capacitor connected across the secondary of the power transformer is shorted.

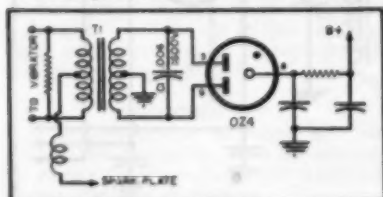
With these three bits of information you can lick the majority of your service problems. What follows is in the nature of a dividend.

Usually, low volume in a receiver is caused by a weak tube or a partially shorted or open antenna. The antennas in car radios make connection to the set proper through a low-loss lead, a very thin wire to reduce capacitance in this circuit. Excessive swinging of this lead will frequently cause the wire to break. Check for continuity to the top of the antenna with an ohmmeter; also check from antenna to ground for a possible short. In the latter case, if the reading is very low, check the circuit diagram to make certain that the set does not have one of its ganged, permeability-type tuning coils connected directly to ground before suspecting that the antenna is shorted. (See Fig. 4.)

Occasionally, you may find that the tubes in the set are blowing for no accountable reason. In the modern automobile, the generator delivers about 7.4 volts. If the automobile voltage regulator, a 2- or 3-coil relay affair, is defective or possibly has a loose connection, or the automobile battery is defective, this voltage will go to the tubes and blow them.

For a quick method of localizing any other trouble, go to the power output stage. Pull the tube from its socket. If continuity to the speaker exists, a click should be heard. Of course, if the output is push-pull, try both tubes. Then proceed to the detector, repeating the procedure. If continuity to the speaker exists, the click should be louder, having gone through a stage of amplification. In a similar manner, proceed through the remaining stages, i.e. amplifier, converter, and r.f. amplifier. If the clicks become louder each time, the trouble lies ahead, probably somewhere in the antenna. Otherwise, you will reach a stage where the click disappears. That is the stage to check.

Fig. 2. Auto radio rectifier circuit using an 024 gas rectifier. Capacitor C_1 is the buffer which aids in the transfer of energy from the vibrator to the transformer and also helps to absorb some of the high voltage transients present at the vibrator points.



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30 WATT AMPLIFIER



The new McIntosh power amplifier MC-30 is unequalled for quality reproduction of high fidelity sound. The basically different, patented McIntosh Circuit *guarantees* a new standard for low distortion — 1/2% harmonic, 20 - 20,000 cycles, even at full power output! Hum and noise level — inaudible (90 db below full output). This outstanding performance assures new listening enjoyment without fatigue. Quality crafted by amplification specialists for lifetime satisfaction. There's nothing like the McIntosh. Hear it at your dealer's.

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McINTOSH LABORATORY, INC. 326 Water St., Binghamton, N. Y.
Export Division 25 Warren St. New York 7, N. Y. Cable: Simontrice, New York

Servicemen • Technicians • TV Dealers

Which Tube is Bad...

Here's How to Quickly Find Bad Tube in New Series Filament TV Set.



**IT'S EASY . . .
QUICK and SURE!**

Senco
Series F

Series Filament TUBE CHECKER

Quick continuity check, no shock hazard. Also voltage indicator when line cord is shorted. No switches or instructions — merely plug in any TV tube, also used for AC-DC RADIOS and PORTABLES.

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Author's Note

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Instruments
Company

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SAVE AT HARJO!

CONVERTED APS-13

Brand New—For 420 MC Use!

Completely converted and ready to operate. Complete with built-in power supply, mike. Just hook up to antenna, plug into any 110V., 60 cy. and you're on the air! Compare this price.

TN-65/APC-19 for a 2-METER XMTR. With GJO, 2-8C4's, two 632. With schematics **\$7.95**
and construction sheet.

MICRO SWITCH BX-7MDT. Now \$ for \$2 postpaid
\$1.5 OHIO COAX. CABLE **\$4.50**

RG34U 71 OHM COAX, .625 dia, 5 KW rating,
85' roll with pi-173 plug at one end. **\$7.95**

MINIATURE LINE MATCHING TRANSFORMERS. \$1 plus 25¢ postage. For blocking oscillators on TV sets, & camera input circuits, tone oscillator transformer for electric organ, for digital computer systems. 1960's other uses. **\$1.00** plus 25¢ postage

24 V TRANSFORMER & RECTIFIER COMB. a basic 24V. DC power supply of 110 V AC primary. 24V secondary and Rectifier Rectifier. Operates intermittently up to 3 or 4 amps. **\$2.95**

SPECIAL PURCHASE!
NEW RCA TV CAMERAS

Just Received!
\$19750

Hundreds of Used Models sold at \$225 and Up! Never before a buy like this! Rig up your own TV watchdog for swim pools and other uses—plus training and experimental work. 1846 Iconoscopes, 6-stage video amplifier and clipper. Write for complete tech. data.

Please send check with order (no C.O.D.'s)
Prices F.O.B. Waco.

Harjo Sales Co.

Dept. RP-4100 Burbank Blvd., Burbank, Calif.
WRITE for FREE CATALOG



Fig. 3. Typical auto radio vibrator with the case removed. Welding of the contacts is one of the three most common sources of auto radio trouble.

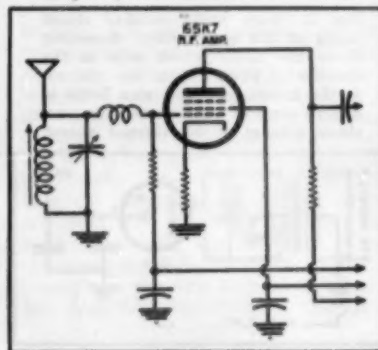
Manufacturers' diagrams, with their resistance and voltage readings, will help you here.

Simple enough, isn't it? In 24 years of automobile radio servicing, during which an average of 25 car radios a week was checked, one service technician found it necessary to replace only two power transformers during all that time.

As to service charges for removing and testing a set, they will range from \$2.00 to \$8.00 depending upon the difficulties encountered in getting at the chassis.

This article has not attempted to delve into any of the intricacies of automobile radio servicing, being purposely limited to a discussion of elementary faults. It was simply intended to bring certain bread-and-butter facts to the attention of the service technician who has not previously been aware of them. So remember the three major sources of trouble given at the beginning of this article, or paste them where you can refer to them quickly, and go out and get your share of the automobile radio servicing business. And if you should be that one-in-a-million service technician who happens to get that 50th (or unusual case) on your first call, don't despair. The other usual faults are lurking there in the background and will follow along—and often enough to make your investment of time a profitable one.

Fig. 4. Partial schematic of an auto radio whose antenna is connected directly to ground through a tuned coil.



WHAT'S *New in Radio*

The products described in this column are for your convenience in keeping up-to-date on the new equipment being offered by manufacturers. For more complete information on any of these products, write direct to the company involved.

"NUCLIOMETER"

The Radiac Company, Inc., 489 Fifth Ave., New York 17, N. Y. is now offering a new type of multiple geiger tube count rate meter for radioactivity detection where extreme sensitivity is required.

Known as the "Nucliometer," the instrument incorporates 24 geiger tubes for use in geophysical prospecting from a low-flying airplane, a moving vehicle, or on foot. The ex-



treme sensitivity of the cluster of tubes makes the unit applicable for locating deeply-buried deposits of uranium, oil-bearing stratigraphic traps, and minerals such as gold, silver, copper, lead, etc. which are often associated with uranium in nature.

The instrument is available with either 24 standard beta-gamma geiger tubes or with bismuth coated cathode geiger tubes.

SHEET METAL BRAKE

Of interest to hobbyists and service technicians who do custom work is the new sheet metal folder being offered by Television Accessories Co., Box 6001, Arlington 6, Va.

This A. B. Parker-designed unit forms angles, brackets, channels and



even chassis and brackets when used with attachments. It will handle aluminum, copper, brass, or steel up to 18 gauge by 24 inches wide. The brake clamps in any workshop vise.

For additional details on this British-made unit, write the U. S. representative direct, Dept. 87.

SERVICING KIT

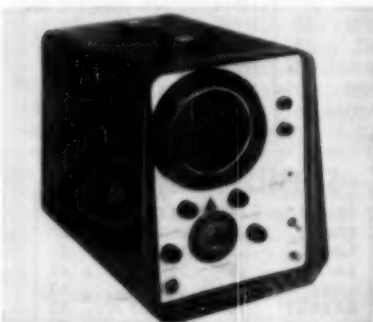
A printed circuit servicing kit for dealer-technicians has been introduced by Admiral Corporation, 3800 Cortland Street, Chicago 47, Illinois.

The kits have been introduced because most of the chassis in the company's 1955 line use printed circuitry. The kits contain a resinous lacquer (to protect the circuit from moisture and dust accumulation), a solvent for the lacquer, a solder that lends itself to use by service technicians in repairing printed circuitry, two special hand tools developed by the company for servicing printed circuits, and a service manual.

WOBBULATOR SIGNAL GENERATOR

Canoga Corporation, 5955 Sepulveda Blvd., Van Nuys, California is now offering an improved version of its wobbulator signal generator.

Fast and easy to use, the new Model 705 is an integral unit combining a swept frequency signal generator with a built-in oscilloscope. The new model has a frequency range from 2 to 1000



mc. and offers continuous single-knob tuning with calibrated dial. Featuring an all-electronic sweep circuit, it is possible to sweep in frequency any bandwidth of 100 mc. or smaller. The amplitude variation is less than .01 db/mc.

For complete information regarding this unit, write direct to the company.

DELAY LINES FOR COLOR TV

Advance Electronics Co., Inc., 451 Highland Ave., Passaic, N. J. has developed a new "High-Z" miniature delay line especially for color television applications.

Meeting the requirements for high impedance, low attenuation, and essentially linear phase characteristics for color TV, oscilloscopes, pulse amplifiers, etc., the physical size and weight of these delay lines is less than 6 1/2" long, 1/4" diameter, and weigh less than 6 ounces.

The 1800 ohm characteristic impedance is a definite advantage in video amplifier circuits because high amplification and less power consumption for high signal level can be achieved.

For the types of delay lines avail-

TENTENNA
PAT. PENDING

NO-GHOST

MODEL T-100
FOR ANY TV & FM RADIO

NEW ELECTRONIC TV ANTENNA

• OPERATES INDEPENDENTLY
AS AN INDOOR ANTENNA OR IN
CONJUNCTION WITH ROOF OR ANY
EXISTING ANTENNA



ONLY
3 3/4" x 2 1/4"
ELIMINATES
GHOSTS - FUZZ - FLUTTER &
ELECTRICAL INTERFERENCES

You'll be amazed at the improved television reception you will receive with this new engineering development. ONLY \$795

• NO NEED FOR
RABBIT EAR ANTENNAS
• CALIBRATED VISUAL INDICATOR
• 10 VARIABLE TUNING CIRCUITS
YET SO SMALL IT CAN BE HIDDEN
FROM SIGHT ANYWHERE

NO GHOST is a research developed electronic instrument designed to operate as a ghost and interference eliminator. It's ten position circuit is intended, by a process of matching, mismatching or damping to serve to resonate the input circuit to bring in the strongest, clearest signal and to trap out unwanted electrical interferences.

At Your Local Dealer
Manufactured By
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NEW STOCK OF FIRST QUALITY TELTRON TUBES GUARANTEED! ... LOWEST PRICES EVER!

All tubes individually boxed ... unconditionally guaranteed for one year!

GIFT OFFER!
One 6BG6 tube
will be shipped
FREE with any
order accompanying
this ad.

FREE BONUS OFFER!



MODEL 435K
• Illum. gear-driven "Speed Rollchart"
• New lever-action switches for individual testing of every element
• Tests all conventional and TV tubes
This Eico Tube Tester is yours FREE when you buy \$199 worth of tubes or more within 60 days at Teltron.

May be bought outright from Teltron for \$34.95

Type	Price	Type	Price	Type	Price	Type	Price
1A7GT	.53	6AK5	.96	6F5GT	.44	12B4	.72
1H5GT	.51	6AQ5	.48	6H6	.50	12AL5	.48
1L4	.51	6AR5	.48	6J5GT	.49	12BA7	.58
1L6	.51	6AT6	.37	6J6	.61	12BH7	.61
1LC6	.49	6AU5GT	.60	6L6	.78	12BY7	.65
1N5GT	.51	6AV5GT	.60	6Q7	.40	12BZ7	.63
1R5	.51	6AV6	.37	6S4	.41	12K7	.40
1U4	.51	6AX5GT	.60	6S8GT	.65	12SA7	.45
1U5	.43	6BA6	.56	6SA7	.45	12SL7GT	.60
1X2	.65	6BA7	.58	6SK7	.45	12SK7	.45
2A3	.35	6BC5	.48	6SL7GT	.60	12SN7GT	.56
2A7	.35	6BE6	.46	6SN7GT	.60	12SQ7	.38
3Q4	.53	6BF5	.48	6T8	.71	19BG6G	1.48
3Q5GT	.61	6BF6	.48	6V3	.80	19T8	.71
3S4	.48	6BG6G	1.18	6V6GT	.48	25BQ6GT	.82
3V4	.48	6BK5	.75	6W6GT	.53	25Z5	.55
5V4G	.49	6BJ6	.51	6X4	.37	25Z6GT	.36
5Y3GT	.30	6BH6	.51	6X5GT	.38	35B5	.48
5Y4G	.40	6BK7	.78	6X8	.80	35C5	.48
5Z3	.42	6BL7GT	.78	7F8	.49	35W4	.33
6A8	.40	6BN6	.90	12AL5	.43	35Y4	.42
6AL5	.43	6BQ7	.85	12AT6	.37	35Z5GT	.33
6K7	.40	6BY5G	.60	12AV6	.43	50A5	.49
6AB4	.73	6BZ7	.95	12AV7	.73	50B5	.48
6AF4	1.12	6C4	.41	12AX4GT	.60	50C5	.48
6AG5	.62	6CD6G	1.63	12AX7	.61	117Z3	.33
6AH4GT	.65	6CU6	.95	12AZ7	.65	117Z6GT	.65
6AJ5	.96	6F6	.42				

FREE \$7.20 list value Bonus Box of three 6SN7 tubes and 25 assorted resistors with each order of \$25 or more.

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48 Hour Postal Delivery To West Coast

TERMS: Save all freight and postage charges. All orders accompanied by full remittance will be shipped POSTAGE PAID anywhere in the continental U.S.A. 25% deposit required on C.O.D.'s. Minimum order \$18.95. Open accounts to rated firms only.

Send for Free complete tube listing and monthly specials! Get on our mailing list.

SPECIALS!—till APRIL 1st—

1B3GT	.55	6SQ7	.35
1T4	.47	6U8	.69
5U4G	.38	6W4GT	.35
6AC7	.59	7N7	.48
6AU6	.34	12AT7	.67
6AX4GT	.54	12AU7	.52
6BQ6GT	.73	25L4GT	.37
6CB6	.47	50L6GT	.44
6K6GT	.35	TYPE 80	.36

TELTRON ELECTRIC COMPANY

428 Harrison Ave.,

Harrison, N. J.

Dept. RN-3

Phone HUmboldt 4-9848

10 Element DELCO Yagi

—with All-Aluminum Elements!!

Available for Channels 4, 5, and 6 only

Please Specify Channel when Ordering

Outstanding performance under the most adverse receiving conditions is a characteristic of this amazing antenna. Extra-wide spacing of elements assures maximum gain and razor sharp directional characteristics. Very high front-to-back ratio reduces annoying "ghost" signals. New 10 element inline design produces more than twice as much gain as conventional double-stacked 5 element yagis and yet is much lower in cost, easier to install, and has a better rooftop appearance. All elements are made of heavy gauge aircraft aluminum and the crossbar of triple-galvanized 12 guage steel tubing for added structural strength. Twin "V" brace gives added support to crossbar—eliminates needless worry whenever the wind begins to blow.

Stock No. 88-9-80610 Reg. \$34.95 \$7.50

Reg. \$34.95

\$6.95 ea. Lots of 3

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CONCORD RADIO 54 Vesey St., N. Y. 7,
Dept. N3
20% deposit with C.O.D. **MINIMUM ORDER \$5.00**
☐ Please send NEW 1955 CONCORD Catalog!
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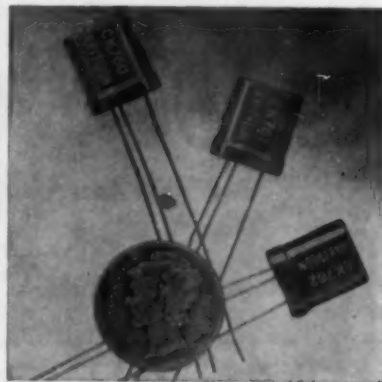
CONCORD RADIO • 53 VESEY ST. • NEW YORK 7, N. Y. • Digby 9-1132

able, along with information on the time delays, write the company direct.

R. F. GERMANIUM TRANSISTORS

Raytheon Manufacturing Company, 55 Chapel Street, Newton 58, Mass. has recently announced the availability of three radio frequency fusion-alloy germanium transistors.

The new Types CK760, CK761, and CK762 with alpha cut-off frequencies of 5, 10, and 20 mc. respectively, are



hermetically sealed and use a polarized lead arrangement for ease in socketing.

Collector capacity for each type averages 14 μ fd. and extrinsic base resistance for each is about 75 ohms.

Further information on these new transistors is available from the Technical Information Service department of the company.

REJUVENATOR-TESTER

B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill. has announced the availability of a new, simplified, portable, low-cost cathode rejuvenator-tester.

With the new instrument a technician can quickly check and repair weak and inoperative TV picture tube in the customer's home without removing the tube from the TV set.

In addition the new instrument can be used by service and set dealers to



restore dormant tubes to useful service, cut down on tube storage and transportation, and save money on re-conditioning TV set trade-ins, according to the company.

The unit will test for emission, inter-

RADIO & TELEVISION NEWS

DON'T BUILD AN AMPLIFIER!!! CHEAPER TO BUY THIS!

G.L.'S OWN HI-FI AMPLIFIER! Best for least! 12AU7 and 12AX7 form cross-coupled direct-coupled cascade cath-follower input and phase splitter for push-pull 12AU7 driver. Two 6V6GT ultra-linear output circuit with specially designed screen-grid-tapped super-hi-fi hypercell output driver. Overall voltage feedback phased on cannot oscillate plus overall current feedback for infinite speaker damping, plus two feedback loops from output to driver to completely cancel phase shift in the only coupling capacitors used. Pot balancing thru drivers, with meter pin jacks plus ditto for output. Outputs 4, 8, and 16 ohms. 10 watt average, 14 w. peak. Less than 1% IM at 10 w. Harro. Dist. less than .01%. Virtually flat from 2 cycles to over 100,000 cycles! Built-in 6V3GT power supply. With schematic. Chrome-plated chassis. 4 1/2" x 14 1/2" x 5 1/2" high overall. Satisfaction guaranteed!

\$69.50

Only PREPAID—No shipping cost!
(No Volume control, tone controls, or preamplifier)

PENTRON TUNER FOR ABOVE AMPLIFIER

Model AFM contains volume control, separate bass and treble controls and phone preamps with 5 equalizers. Magnificent performance, professional quality. Low-noise grounded-grid RF. Best for both quieting. Armstrong APC, with in-circuit switching for weak stations. Flat 20-30,000 CPS. Selective switch chooses tape, FM, AM, crystal phono or magnetic phono. Cath-follower output. Flywheel tuning. Illuminated slide-rule dial. Beautiful panel ideal for built-in jobs. Best at any price.

\$89.95

And only PREPAID—No shipping cost!
SPECIAL COMBINATION PRICE!
AMPLIFIER AND TUNER, **\$149.50**
BOTH PREPAID. ONLY.....

A Miracle in Hi-Fi at Low Price!

PENTRON'S Sensational New CT-1 Recorder

MONOMATIC single-knob control! Your kids can work it! 7 1/2 and 3 1/2 inches/sec., record and play back forward and backward (dual track). Instantaneous automatic breaking on both reels. Fast forward, fast rewind. Flutter less than 0.5% at 7 1/2 IPS. Exclusive new heads. Two-hour capacity. In attractive 2-tone leatherette carrying case. Records and plays in any position, even while carrying it!

\$99.50

PREPAID! No shipping cost!
All other models in stock and shipped prepaid.

Write for info on speaker, speaker cabinet, and record player we recommend! **GET A PLEASANT SURPRISE AT THE PRICE!**

PROSPECTORS!

IF YOU ARE GOING TO HUNT FOR URANIUM, STOP KIDDING AROUND LOOKING FOR THE CHEAPEST UNIT YOU CAN BUY! In this business, it pays like anything to GET THE BEST—AND THESE ARE THEM!

FREE! With order, 143 p. book with full color illustrations on uranium prospecting.

MODEL 111—The "Scintillator"

AEC No. 5P11A—Portable Scintillation Counter. Many times more sensitive than Geiger Counters. Lightweight, simple to operate. Detects at depths of a few feet to a few hundred feet depending on conditions. Primarily for URANIUM detection. Shockproof, Waterproof, Tropicalized.

SPECIFICATIONS:
Probe size..... 8" x 1 1/2"
Probe weight..... 2 1/2 lbs.
Box weight..... 4 lbs.
Range..... .025..... 625.....
.05, .25, .5, 2.5 and 5 MR/HR **\$495.00**
Price complete, PREPAID.....

ALL OTHER PRECISION RADIATION DETECTORS IN STOCK INCLUDING COUNTER LOW AS \$29.95 WRITE FOR CATALOG.

\$45.00 HI-FI HEADSET AT \$7.95

Uses angular grooved plastic plate cones with voice coils as in speakers and padded charcoal ear muffs to obtain spacing for current acoustical load. Gives finest music reproduction, 600 ohms. Checked out with freshly laundered ear pads and long flexible leather cord with phone plug. (Shop. wt. 2 lbs.) **\$7.95**

POWER FROM THE SUN

Brand new development, brand new units (not surplus). Thumbell size SUN BATTERY puts out 2 ma. into 10 ohms in average sunlight. Series-parallel them for greater output. With data sheet. **\$5.00; 3/\$15.00**

BABY WINCH

Highly versatile. Use as winch, barbeque spit drive, beam rotator, or any other use which requires a low speed, high torque source of power.

Has two output drives. One is sprocket-toothed wheel, other is rubber-coupled castor drive. Both reversible by electric switching.

24 VDC motor runs perfectly on 8 to 24 V. 60 cV AC. Complete with simple instructions. **NEW \$6.95**
G. L. ELECTRONICS, INC.
905 S. Vermont Ave., Los Angeles 6, Calif.
Minimum Order \$2.50 Total. 25% Deposit Required
All Prices F.O.B. Los Angeles. Add Sales Tax
GET ON OUR MAILING LIST

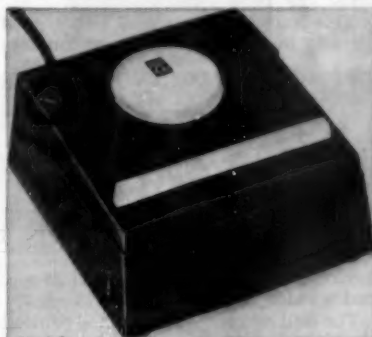
element shorts, leakage, open circuits, grid cut-off, gas content, and probable useful life. It restores emission and brightness, removes shorts, and repairs open circuits.

Further information and literature on this unit are available from the company.

ALLIANCE ROTATOR

The Alliance Manufacturing Company, Alliance, Ohio is now in production on a new, low-priced "Tenna-Rotator," the Model K-22.

Featuring a fingertip control bar which rotates the antenna in one di-



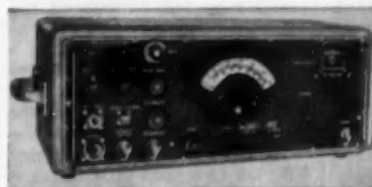
rection when pressed on one end and in the opposite direction when pressed on the other, the new unit consists of a rotator unit, fully enclosed in a split die-cast zinc housing, and a streamlined control unit encased in a modern plastic case. The unit is mounted on the antenna mast and the control box is placed on or adjacent to the receiver.

An automatic center disc signal light indicates when limit of travel in either direction is reached. Speed of the unit is approximately 2 rpm.

INTERFERENCE-INTENSITY METER

Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, California is now offering a radio interference-field intensity meter for the accurate measurement of field intensities of signals and r.f. disturbances within the frequency range of 20 to 400 mc.

The Model NM-30A covers the frequency range which includes such important services as television, FM, in-



ternational broadcasting, transportation, aeronautical, industrial, amateur, and many others.

Radio signals or interference, either radiated or conducted, may be measured through the use of accessories which are available for the equipment. Sine wave, pulsed r.f., impulsive, and random noise may be readily measured. The unit may also be used as a

Never Have You Heard Such Fidelity

READ ABOUT THE
GOODMANS
Axiom 80
AND OTHER
GOODMANS
LOUDSPEAKERS

ROCKBAR CORPORATION, DEPT. BC-3
215 East 37th Street, New York 16, N. Y.

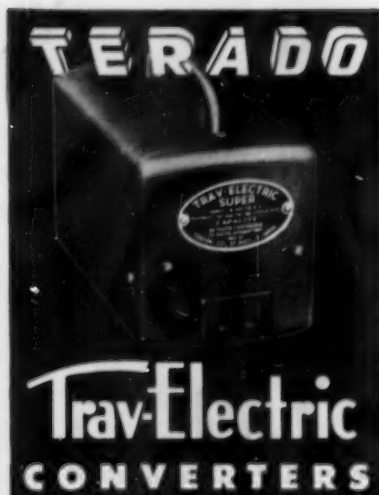
Please send complete description of the Axiom 80 and other Goodmans loudspeakers.

Name.....

Address.....

City..... Zone..... State.....

My Dealer is.....



Provide House Current Anywhere

—from battery in car, truck, boat. At the beach—picnic grounds—at cabin—on trips—anywhere!

Easy! No installation! Just plug Trav-Electric into cigar lighter on dash.

Trav-Electric Operates:

- Tape Recorders
- Electric Shavers
- Radios
- Soldering Irons
- Dictating Machines
- Small Electric Drills
- Portable Phonographs
- Etc., etc., etc.

6 Models—10 to 100 Watts
—a size for every need

"MIDGET"

Model 6-11160
10-15 Watts
About as small as a
pack of cigarettes
\$11.95 LIST



PORTABLE PHONOGRAPH



DICTATING MACHINE



ELECTRIC SHAVEN

"JUNIOR"

Model 6-110
115 Cycle—35-60 Watts
\$12.95 LIST

"SENIOR"

Model 6-1160
Size 2 1/2" x 2 1/2" x 4 1/2"
35-60 Watts
\$15.95 LIST

"MASTER"

Model 6-51160
40-50 Watts
Size 4" x 5" x 6"
\$27.50 LIST

"SUPER"

Model 6-71160
(Shown at top of ad)
60-75 Watts
Size 4" x 5" x 6"
\$37.95 LIST

—and now, the "CHIEF"

New—just out—Model 6-81160—75-100
Watts—automatic on-off switch—
\$49.95 LIST

See your Electronic, Hardware,
or Automotive Jobber or Dealer

Terado Company

Designers and Mfrs. of Electronic Equipment
1058 Raymond Ave., St. Paul 14, Minn.

In Canada Write: Atlas Radio Corp., Ltd.
560 King St. West, Toronto 28, Ont.
Export Sales Division: Scheel International, Inc.
4237 N. Lincoln Ave., Chicago 18, Ill., U.S.A.
Cable Address—Harshel

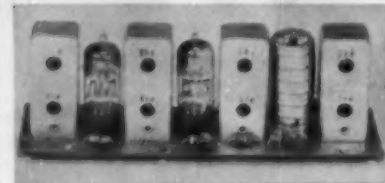
two-terminal frequency selective volt-
meter.

Printed circuitry and miniaturiza-
tion are incorporated in this equip-
ment. This results in a smaller, lighter
weight, more compact unit. The in-
strument will operate from either 105
to 125 volts or 210 to 250 volts a.c.
single phase and at any frequency be-
tween 50 and 1000 cps.

PRINTED CIRCUIT I.F. DECK

The Allen D. Cardwell Electronics
Products Corp., 97 Whiting Street,
Plainville Conn., has announced the de-
velopment of a new printed circuit i.f.
strip, the PC-4.

This low-cost component is designed
for use in monochrome television sets



having a sound carrier i.f. of 41.25 mc.
and a video carrier i.f. of 45.75 mc.

The unit combines established printed
circuit techniques with progressive circuit
design. It can be supplied with
base and coils fabricated of XXXP Phen-
olic or in cases where maximum electri-
cal and mechanical dependability are
required, of Epecard II, a new
laminate with extremely low-loss and
high strength developed by the company.

REJUVENATOR-TESTER

TeleTest Instrument Corp., 31-01
Linden Place, Flushing, New York has
combined two servicing instruments
into a single compact, portable instru-
ment.

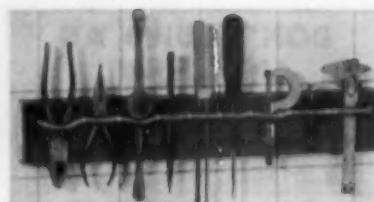
The new unit will both test a CRT
and rejuvenate it. Known as the "Re-
juva-Tester," the instrument checks the
CRT for inter-element shorts in
both hot and cold conditions when
used as a tester and rejuvenates by
removing contamination from the cath-
ode surface and correcting gassy picture
tubes.

VIDEO SWEEP GENERATOR

Tel-Instrument Company, Inc., Carl-
stadt, New Jersey has announced the
availability of a new video sweep gen-
erator, the Type 1106.

Designed for the observation of fre-
quency vs amplitude characteristics of
wide-band circuitry and suited for
color television video test purposes, the
new unit has a wide video frequency
sweep of 50 kc. to 6 mc. with uniform
output adjustable from 1 millivolt to 2
volts peak-to-peak into a 72-ohm load
from a source impedance of 75 ohms.
Front panel switches control a maxi-
mum of 10 optional crystal markers,
each of which is furnished to cus-
tomer specifications.

The beat frequency of 50 kc. to 6 mc.
is produced by mixing the frequencies
of two oscillators, one fixed and the
other having extremely linear incre-



GRIP-R tool and utensil holder

Holds Anything With or Without Handles
Radiomen, Machinists, Hobbyists, Supply Stores
Flexible spring with adjustable clips—grips
tools of various sizes and shapes, with or with-
out handles. Holds smallest drill bits or taps.
Keeps your valuable tools from getting lost
by rolling off bench. GRIP-R will pay for it-
self in no time at all. Will not magnetize your
tools. Made for fast manipulation—for work
bench, table, wall, or may be mounted in
series. Finished in baked hammered enamel.
Size: 1 1/2" x 2 1/4" wide. Price each \$1.29 shipped
prepaid. Money Back Guarantee.

SEARLE OF CHICAGO Dept.

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LOWEST PRICES IN THE WORLD

#630 SUPER DELUXE 31-TUBE TV KIT

You receive a COMPLETE SET OF PARTS AND TUBES.
Everything needed is included with easy to follow step-
by-step INSTRUCTIONS (less CRT and wires).

Shipped to..... **\$9999**

TV WIRE & SOLDER KIT, for any Set.....\$.98
PULSE KEYED AGC KIT, 24108 included..... 2.99
UNIVERSAL CRT MOUNTING BRACKETS... 4.97
5" PM SPEAKER, stereo low magnet..... 4.99
AUTO SET, underdash fits any Car, complete... 26.97
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HI-FI AM-FM TUNER, 10 tube amplifier..... 44.38

BROOKS LIFE-SIZE TV INSTRUCTIONS,
for building any #630 TV Receiver... **\$125**
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HINTS FOR BETTER PERFORMANCE
on your #630 TV receiver..... **50c**
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BROOKS CASCODE MANUAL, how to
install Cascode Tuner in any make
TV Set..... **25c**
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BROOKS, 84 Vesey St., N. Y. 7, N. Y.

RCA MI-2475 SOUND POWERED PHONES NEW EXPORT PACKED

completes with 23" rubber covered
cable procs in talk switch are tight
weight, the sets is on a swivel boom
that can be moved to any position
in front of face. Press to talk
switch clips on jacket front can
be locked in on position.

NO BATTERIES or other vlt-
age need, ear
just connect to two conductor wires
—need over mile or longer.

Brand new, **\$1395 Ea.**
Gov't Cost, 963. Shipping wt. 4 lbs.

PLUS THESE EXTRA SPECIALS

TV PICTURE TUBES 14DP4 \$10.00, 16HP4
16KP4, 16PT4 Raytheon 891, brand new: Quar. \$18.95
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HEADSET TELEPHONE Mod. 2570 reg. 14.00 3.95
MICROPHONE SHURE 707A & 904B desk stand 1.85
WIRE KNOCKUP 10 anti-dust grey W.E. 1800 ft. roll 2.95
WR-30A TEL. cord / / canvas case..... 3.95
TEST SET 1-236 for AC DC and Ohms with probe 3.95
Include postage with order.

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TRI-STATE COLLEGE

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RADIO & TELEVISION NEWS

mental frequency characteristics. The resultant signal is amplified and made available at the output terminals through front-panel attenuator controls. Attenuation from 0 to 63 db is accomplished by a push-button attenuator with 20 db, 20 db, 10 db, and 3 db steps, in addition to a continuously variable 0-10 db attenuator.

HEATH SCOPE KIT

The Heath Company, Benton Harbor, Michigan is now marketing the second of its three new scope kits which will be introduced to the line this year.

The Model OM-1 is designed especially for service technicians and for all general oscilloscope applications.



The new twin-triode sweep circuit operates up to 100,000 cps, it employs a full 5-inch 5BP1 cathode-ray tube, has a three-step frequency-compensated input attenuator, and push-pull deflection amplifiers.

In addition the new unit uses printed circuits to reduce assembly time and provide constant circuit performance. The kit is characterized by the company's new color and knob styling. Full technical specifications and price information are available from the company on request.

INTERFERENCE FILTER

JFD Manufacturing Co., Inc., 6101 16th Avenue, Brooklyn 4, New York has introduced a new device which eliminates television interference caused by adjacent channel and spillover signals.

The new interference filter is currently available in two models; the No. WT26 for channels 2-6 and the No. WT713 for channels 7-13. The unit is not designed to handle co-channel interference problems but its 35 db attenuation factor does provide a solution to adjacent channel and spillover problems.

TINY TV "STATION"

The Communication Products Division of Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Avenue, Clifton, New Jersey has developed a new television "station" the size of a cigar box which sends clear, sharp, closed-circuit television pictures by cable to screens of standard television receivers.

Especially for industrial television use, the "Tel-Eye" has been redesigned

March, 1955

MICROPHONES

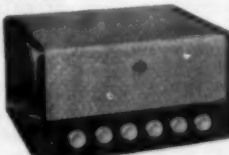
Aero-dynamic
Velocity
Pressure
Amomuse
Miniature



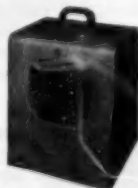
INTERCOM SYSTEMS—Time and money savers for hotels, stores, offices, plants. Available with 6 or 12 station buttons.



SPEAKERS—Both portable and fixed. For indoors or out, ceiling or wall.



AMPLIFIERS—For all types of public address systems: 6, 15, 30 and 50 watts.



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RCA MATCHED
SOUND PRODUCTS
HELP YOU TO

Do the job right the first time!

Then your net profit is really *net*.

The performance of every RCA component is backed by more than 25 years of engineering research and the development of professional audio equipment—equipment you can sell and install with confidence... and top profit.

Look over the likely prospects in your neighborhood... night clubs, restaurants, dance halls, arenas, hotels, fair grounds, parking lots, supermarkets—all are interested in sound amplification for business or entertainment. Then take your specifications to your RCA Distributor. He has every item you need for any sound installation. *One stop, one quality—RCA. The name that's known the world over.*



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RADIO CORPORATION of AMERICA

Engineering Products Division, Camden, N. J.
In Canada: RCA VICTOR Company Limited, Montreal



CUT COSTS
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Branded tubes—guaranteed one year. All tubes individually boxed.

*Because of the tremendous response to our summer offer, this sale is being extended, for a limited time only.

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SPECIAL—New—Jan 30/44—25 pcs or more
@ 15¢

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Type	Price	Type	Price	Type	Price
1B3	..59	6B6	1.00	12AT7	..67
1B5	..40	6B7	..70	12AU7	..55
1X2	..61	6B8	..70	12AV7	..67
5U4	..45	6C6	..45	12BA6	..44
5V4	..55	6C8	1.10	12BE6	..44
5Y3	..40	6H6	..36	12BM7	..57
6AB4	..46	6J5	..40	12RA7	..52
6AC7	..60	6J6	..40	12BK7	..50
6AG5	..46	6K8	..36	12BN7	..53
6AK5	..70	6M7	..40	12SQ7	..40
6AL5	..42	6BK7	..40	12XG6	1.30
6AT6	..38	6BL7	..50	12XG6	..74
6AU6	..61	6B7	..40	30L6	..40
6AU8	..40	6B7	..40	30L6	..40
6AV6	..38	6T6	..70	30W6	..40
6AX4	..55	6V6	..40	30Z5	..40
6BA6	..54	6W4	..40	30L6	..42
6BC6	..46	6W6	..51	11Z3	..38

Tubes not listed take 75% off list. 25% discount on orders over \$50—5% over \$75—10% over \$125
TERMS: 25% with order, balance C.O.D. Orders over \$15.00 with full remittance, prepaid to you in Continental U.S.A. Prices subject to change without notice. Minimum order \$10.00.

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specify these 3 ϕ , 400~ isolation transformers

Hermetically sealed * meet MIL-T-27 grade 1, class A requirements

Primaries 115V, 3 ϕ Δ
380-1000 cycles

T-806-H Sec. 26V, 3 ϕ Y
0.65 amp A.C. per ϕ

T-810-H Sec. 26V, 3 ϕ Y
1.3 amp A.C. per ϕ

	Dimensions	Weight
T-806-H	2½"x4"x1½"	1.95 lbs.
T-810-H	3½"x4"x1½"	2.4 lbs.



Write today for quotation on your special requirements.



PEERLESS
Electrical Products

A DIVISION OF



3536 Santa Monica Blvd., Beverly Hills, Calif.
181 Sixth Avenue, New York 13, New York

so that it is much smaller and lighter than previous models. It is only 10" long, 6½" high, and 4¾" wide and weighs 8½ pounds.

The "Tel-Eye" comprises a completely self-contained TV broadcasting system and no intermediate units are needed between the camera and the receiver. It will operate from a standard 117-volt a.c. wall socket and under normal room lighting conditions.

The company will supply full technical details on request.

TRANSISTOR TESTER

Devenco Incorporated, 150 Broadway, New York 38, N. Y. has placed on the market a new and relatively inexpensive junction transistor tester which provides a rapid and positive



means of testing the current gain of any n-p-n or p-n-p junction transistor.

A front-panel selector switch allows rapid changeover from n-p-n to p-n-p testing. Designed for simplicity, the new tester incorporates direct reading calibration by a single knob adjustment with conversion from beta to alpha values by means of a simple table or curve, both of which are supplied with the unit.

The unit is designed especially for production line testing or for use in laboratories and service establishments. The company will supply additional details on request.

PHONE PLUG ADAPTER

Industrial Devices, Inc., Edgewater, N. J. has now released a new phone plug adapter of molded nylon for civilian applications.

The plug end of the Model #1416 adapter is a standard PJ055B insert. The female end accepts twin test prods of the standard phone type or .080" test prods. Compact size permits use in assemblies where operating space is at a premium. The unit measures 3¾" long by 1½" by ½". Complete specifications are available on request to the company.

TV SERVICE BENCH

Baumker Manufacturing Company, 3865 Summit Street, Toledo, Ohio has recently introduced a new service bench for television technicians which is said to eliminate virtually all chassis handling.

The bench is of wood and steel construction with a movable center table for quicker, more efficient, and safer work. It measures 72" long by 36"

RECORDING TAPE (Plastic Base) 40% OFF (NEW)

- 1200 ft. plastic tape with plastic reel included.
- Each reel individually boxed.
- Choice of nationally famous top quality brands such as:
- Reeves (RPN-18) 3.30; Audio (1551) 3.30; Scotch (111-A) 3.35; Sencore 3.35; Irish, Professional grade (311) 3.30.
- FREE! A 7.95 tape carrying case included with purchase of 12 new tapes!

USED RECORDING TAPE (PLASTIC BASE)

1.89 for 7"—1200 foot
.99 for 5"—400 foot
.59 for 3"—200 foot
.29 for 2"—150 foot

ATTENTION: Radio Stations, electronic calculators, industrial users: We have the new 1½" or 2" mil mylar, "mountain," "lifetime," or "H.O." tapes and we will buy or exchange your present 1 mil mylar or plastic tapes.

USED "MYLAR" TAPE (1 MIL)

(Impact Strength 9 Times Greater Than Plastic Tape)

1200 ft. (7" reel)...2.59
1800 ft. (7" reel)...3.89

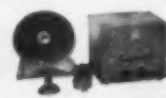


New empty plastic reels in boxes for easy labeling. 3" 10¢; 4" 22¢; 5" 24¢; 7" Professional reel (3½" hub) 25¢ ea. EMPTY BOXES: 3" 3¢; 4" 5¢; 7" 5¢ ea.

We carry all brands of new tape, recording blanks, tape recorders, etc., at low prices. PLEASE INCLUDE SUFFICIENT POSTAGE.

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MOBILE AMPLIFIER IDEAL



FOR
CIVIL DEFENSE, POLICE, FIRE,
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An extremely compact and durable 12 watt amplifier for 6 and/or 12 volts. 2 inputs, one mike, one phono. 2 output connections. 4 volt model list \$89.95.



PLUG IN TUNERS AM-FM— SHORTWAVE

Connect to any TV set, HI FI or PA Amplifier, or Tape Recorder in a few minutes. FM unit (only \$13.95) will work in automobile and can be easily connected to car radio. AM broadcast model \$14.95. Balanced heaters no carrier hum. Fractional power requirements.

Write for literature

KUHN ELECTRONICS

26 GLENWOOD CINCINNATI 17, OHIO

ENJOY 3 COLOR TELEVISION FILTER SCREEN NOW

Changes dull eye-straining black and white pictures into beautiful color tones. Seconds to attach. No tools used. Holds eliminate glare. Order direct. Send \$1 for screen size up to 16". \$1.25 size 17". \$1.50 size 20". \$2 size 21". \$2.50 size 24". \$3 size 27". We pay postage except on C.O.D. orders. Satisfaction guaranteed. Inquiries from dealers also welcomed. Zingo Products, Johnstown 19, New York

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Radio engineering is a big field. There's room for you in it—if you're good. Get first-class training at Indiana Tech. Intensive, specialized course, including strong basis in mathematics and electrical engineering, advanced radio theory and design, television, electronics. Modern laboratories. Low rate. Also B.S. DEGREE IN 27 MONTHS in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. U.S. Government approved. Enter March, June, September, December. You can earn part of your expenses right here in Fort Wayne while you are studying.

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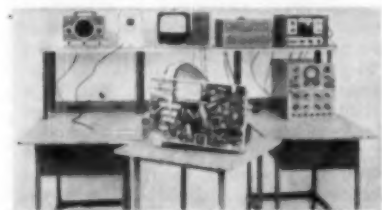
Name _____

Address _____

RADIO & TELEVISION NEWS

deep, and 36" high and has two deep drawers for tools.

The back panel is equipped with five double outlets, a master switch, and a safety indicator when current is on.



When the switch is thrown, all test equipment is automatically turned off. The panel comes fully equipped and wired, ready to plug in.

MINIATURE VARIABLE

A new miniature variable capacitor, designed especially for transistorized radio receivers, has been announced by Radio Condenser Company, Camden 3, New Jersey.

The unit includes two variable sections, both nested to a formed aluminum frame with trimmers on the bottom. The shaft is available with pulleys, flats, knurls, or slots.

Spot Radio News (Continued from page 18)

over the road expeditiously. At the same time, train-to-train and ground-to-train communication by radio facilitates interchange of such information as the discovery of an over-heated journal, or *hot box*, on a passing train or similar information of interest and value in connection with train movements.

Technically, the report added, railroad-radio-communication systems take two principal forms. One is space radio in which messages are sent and received without wires. The other is the inductive carrier service, which utilizes nearby metallic paths, such as rails and wayside wire lines. The extent to which radio has been adopted for railway use is indicated by the fact that as of May 1, '54 there was a total of 16,800 authorized stations and inductive carrier installations, the latter accounting for about ten percent of the total sets.

RAILROADS are also using microwaves, the Washington office reported. One microwave installation now in use covers 70 airline miles in four hops; the first over water, the second over swamp land, and the third and fourth over farm areas. The system replaces the longer pole line which went around the water gap. On this installation are imposed eight telephone channels. One of these is used to provide six channels of telegraphic carrier services; this is possible because much narrower bands are required for telegraphic than for voice transmission. It was also noted that another railroad had substituted microwave for telephone

KESTER

Absolutely non-corrosive and non-conductive, KESTER "RESIN-FIVE" CORE SOLDER contains an activated type of resin that gives you that fast, positive action on all your jobs . . . including the most difficult.

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FOLLOW THE LEADER . . .

Buy **EICO**

6V and 12V BATTERY ELIMINATOR and CHARGER #1050. KIT \$29.95. Wired \$38.95.

- operates 6V and 12V auto radios for servicing and sales demonstration.
- charges 6V and 12V storage and Edison Batteries.
- operates mobile and marine receivers, transmitters, boat lights, electric trains, projection and other equipment.

SPECIFICATIONS

- 6-Volt range: 0-8V (up to 20 Amp.)
- 12-Volt range: 0-16V (up to 10 Amp.)
- variac-type transformer for continuously variable voltage adjustment.
- reads volts and amperes at same time on 2 separate meters.
- Transformer primary and secondary fully protected.

In stock at local jobbers throughout the world. Write for free Catalog #R-3
Prices 7% higher on West Coast

EICO
84 Withers Street
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Kit of 6 tools
\$2.50
(suggested net price)



New Tool Kit
simplifies cutting
of control
and switch shafts

Centralab Shaft-Kut Kit

These tools are especially handy when you have to cut off a shaft, adapt a shaft and knob type, or pry out the slot in a Centralab "R"-type Front Fastatch Dual Control. Here's what you get:



1. Custom-made, hardened carbon-steel, shaft clamp that holds any shaft in a vise, firmly and without damage.



2. Fine-tooth, high-speed hack saw blade that has extra-fine teeth (32 per inch) for a clean cut.



3. Precision, half-round, needle file that is narrow enough to get inside the tubular outer shaft of a dual concentric.



4. "A"-size drill that is just the right size to drill out those few special plastic knobs so that they fit the inner shaft of a CRL Fastatch dual.



5. AK-16 drill stop that limits the depth of cut to the exact dimension required.



6. Small screwdriver that you can use to adjust set-screw knobs, and to do many other jobs.

Ask your Centralab distributor to show you a Centralab Shaft-Kut Kit. See if you don't agree that it can be mighty useful to you in a hundred-and-one different ways. Then buy one.

Centralab

A DIVISION OF GLOBE-UNION INC.
910-C E. Keefe Avenue • Milwaukee 1, Wis.

9-750

lines on a 110-mile stretch because of excessive damage to pole telephone lines during winter weather.

Another phase of electronics now being explored by the roads is closed-circuit TV. Some of the possibilities involve inspection of under-parts of cars, procurement of car numbers in trains reaching or leaving yards, and facilitation of supervision in yards and other installations. Problems to be solved include visibility at night and operation under adverse weather conditions.

Describing a recent instance where television helped to unravel an operating problem, the report said that TV came to the rescue during the installation of a new tower. It had been found necessary to take down a signal tower that controlled movements into a passenger terminal. Another tower, which was to supersede the retired tower, could not afford a view of the entrance to a postal installation, where switching of mail cars was intensive. The problem was solved by mounting a TV system where it commanded the entrance to the post office, enabling the operator in the second tower to watch these switching movements.

Another application of electronics for rail use now being pioneered involves self-identification of trains. An inert coil on the train activates, in passing, a track installation which responds by sending out a coded impulse of the frequency to which the train coil is tuned. Theorizing on the possibilities of this approach, the report said that besides identifying the train, these coded impulses could be made to line up switches for the train's movement into the terminals and perhaps perform other tasks in connection with its arrival.

ANOTHER NEW DEVELOPMENT in communications, now being studied from the standpoint of applicability to railway use, is the "compandor." This

device was developed to improve the intelligibility of speech transmission by increasing the signal-to-noise ratio, thus permitting operation of carrier channels over circuits that otherwise would be unsuitable because of excessive noise and crosstalk. Basically, the device consists of two units; a compressor at the transmitting end of a circuit to reduce the intensity range of transmitted signals and an expander at the receiving end to restore the compressed signals to their original intensity range. Use of the compandor, it is felt, may result in considerable savings in outside plant work and original equipment use, growing out of relaxed equipment design requirements.

WRIST-WATCH RADIOS, often called the ideal portable, if and when they ever reach a practical design stage, now appear to be close to a production point, thanks to the persistence of Signal Corps engineers at Fort Monmouth.

Using three transistors, a 1000-1600 kc. model has been built at the labs with a sensitivity of 50 microvolts; substantial enough to permit pickup of a number of stations in New York 45 miles away.

The receiver consists of one regenerative radio-frequency stage and two audio stages. A point-contact transistor is used in the r.f. stage, with regeneration being obtained by utilizing a transformer, with feedback being controlled by proximity of two coils. A miniature capacitor (8 to 50 μ fd.) is used for tuning. Audio amplification is obtained by a pair of *p-n-p* junction transistors. A bead diode is used as a detector, and another is employed as a d.c. return. Power supply is a 6.5-volt battery ($\frac{1}{2}$ " x $\frac{3}{4}$ "") consisting of five mercury cells (1.3 volts each). Battery drain is about 20 milliwatts, and battery life about ten hours.

Although no antenna need be used in strong signal areas, a one-foot piece

NEW TV GRANTS SINCE FREEZE LIFT

Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.

STATE	CITY	CALL	CHANNEL	FREQUENCY	POWER*
Alaska	Fairbanks	.....	11	198-204	11
Mississippi	Tupelo	.....	9	186-192	28.9
Oregon	Klamath Falls	KFVI-TV	2	84-90	13
South Dakota	Rapid City	.....	3	60-66	1.48
Texas	Waco	KWTX	11	198-204	107.3

NEW CALL LETTER ASSIGNMENTS

STATE	CITY	CALL	CHANNEL	FREQUENCY
Idaho	Pocatello	KWIK-TV	8	82-88
Washington	Pasco	KEPR-TV	19	800-806

ERP = (effective radiated power, kw)

..... Call letters to be announced

HIGH-ACTIVITY CRYSTALS

at Bargain Prices!

3 for \$1.00 10 for \$3.00

Take your pick! Fundamental frequencies in Kilocycles: 910 - 6350 - 6370 - 6470 - 6610 - 6670 - 6690 - 7270 - 7350 - 7380 - 7390 - 7480 - 7580 - 9720. 1/2" pin spacing. Made by Western Elec. Co. All new and guaranteed. The best bargain you ever saw!

Transmitting MICA CAPACITORS

Type A—2000 D.C. Volts Wkg.
 .00002 - .00005 - .00009 - .0001 -
 .0002 - .0004 - .0007 - .0007 - .008
 Only \$4.45 ea. 3 for \$1.00



Type B—2500 D.C. Volts Wkg.
 .00035 - .0004 \$2.25 ea. 4 for \$1.00



Type C—1250 D.C. Volts Wkg.
 .005 - .01 - .025 \$2.25 ea. 5 for \$1.00



NEW REPAIR PARTS FOR BC-348

(Models H, K, L, R only)

4 gang tuning capacitor..... \$ 1.95
 Aluminum front panel..... \$ 2.00
 1st, 2nd, 3rd, and 4th I.F.
 transformer assy..... Each \$ 2.00
 Crystal filter assy. incl. 915 Kc. Crystal..... \$ 5.50
 C.W. Oscillator assembly..... \$ 2.00
 915 Kc. Mounted Crystal..... \$ 2.75
 R.F. Unit Assembly in can..... \$12.50
 Dual Volume Control..... \$ 2.75
 Spinner tuning knob..... \$.50
 Ant., RF, Det. and Osc. coils for bands
 1 to 6 Per Band..... \$ 2.00
 Complete Dial assembly..... \$ 3.95

Variable Condenser Bargains!



High Quality 3 Gang Variable
 Condenser. 250 mmfd. per
 section. Extra rigid design.
 nickel plated brass plates, insulating
 material makes this a really
 choice buy for short wave
 receiver, test equipment, etc. Constructors. P.O.
 Box 2051A \$1.35 ea. 3 for \$3.95
 U.M.F. split-stator, 35 mmfd. per section. Air gap
 .030. Size 4x1 1/2x1 in. Special. 69c ea. 3 for \$2.00

EXPERIMENTER'S ITEM

Fire Detector Unit. Flame heats
 metal case and causes interior
 snap-bias to make contact closing
 alarm bell. Covers may be used in parallel.
 Automatic reset. Originally designed for use on
 planes and tanks. New..... 69c ea. 3 for \$2.00



METER BARGAIN

Brand New G.E. Type D0-50, 50°
 square bezel case meters. Ideal
 for conversion to other ranges. Now
 ready to ship. D.C. Range measurement
 10 ma. full scale volts—0-50.
 \$3.49 ea. 2 for \$6.00



HIGH VOLTAGE OIL CAPACITORS

All Top Brands

Mfd.	KV	Price	Mfd.	KV	Price
.001	5	\$2.50	.01	5	\$2.50
.01	5	1.25	.02	5	1.50
.02	5	2.65	.02	20	17.50
.02	20	5.75	.02	50	44.50
.025	50	25.95	1.	7.5	6.95
.025/.025	50	34.50	1.	15	37.50
.1	5	.95	2.	5.5	9.90
.135	5	6.95	2.	8	12.50

9 CONDUCTOR CABLE

Army Spec. CD-215. Weatherproof 9 cond. No. 20
 AWG stranded twisted copper. plastic ins., color
 coded, double vinyl jackets with lined copper braid
 between. Dia. 3/16". Made by G.E. Available
 1000, 1500, and 2000 ft. runs, at .10 per ft.
 Sample 100 ft. reel..... \$10.00

HI-POWER CHOKE & FIL. TRANS.

CHOKE 15 henries, 450ma., 135 ohms, 8KV test,
 oil-filled. 74500 Ind. 27 lbs. \$9.75
 FIL. TRANS. P-1. 440/220 Ind. 5VCT. 30
 Amps. Test Voltage 4500V H3H8. Raytheon U514.
 Radios' Co. 25 lbs. New..... \$9.95

G.E. Servo Amplifier 2CV1C1 Dual Channel. Type
 used on R20 planes for Control Control System.
 Drives Amplidyne and control motor (listed
 below). New, less tubes..... \$29.50
 Amplidyne generator G.E. 5A3E1N2A for above.
 New..... \$23.50
 Control motor for above G.E. 5A3E1N2A 5 HP.
 1000 RPM. New..... \$37.50

MISCELLANEOUS BARGAINS

BC-608B Interphone Amplifier..... \$4.95
 Commando. P.O. Box 100..... \$1.00
 BC-1360B Jack Boxes..... 3 for \$1.00
 Navy type 5000 400 Hz. New..... \$4.95
 Differential Synchro Type XIX..... \$3.95
 Antenna Matching Units CUG4APT..... \$2.75
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 BC-155A Power Amp. Coil Assy..... \$1.25
 Solenoid 24VDC 50 Stroke, 2 lb. pull..... \$1.45
 50,000 Ohm volume controls..... 10 for \$1.20
 BC-185 Headline Pilot Units..... \$1.25
 Mic. Trans. for BC-379 229944..... \$.80
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 Power Supply Units PE 112A..... \$12.50
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of wire (built into the strap mounting the model) will suffice at other times. The earphone is a small hearing-aid type with an impedance of 2000 ohms.

In the evolution of the tiny model, it was found that with a 60-foot outside wire antenna, only one regenerative stage was required to hear stations in New York City from Belmar, N. J. With the addition of a single audio stage and an output transformer, a speaker could be used. Two stages of audio were required to compensate for the elimination of the antenna. In metropolitan areas the coils alone, it was found, can pick up sufficient signal. When the receiver is held near the body, both the tuning and the regeneration will be affected by body capacitance. Thus regeneration must be optimized for each tuning adjustment.

During the tests, it was also noted that regeneration could be more easily controlled electronically, than by moving a coil. One method tried involved insertion of a small 2000-ohm potentiometer in series with the collector coil. A trimmer capacitor was also found effective for feedback when connected from collector to emitter; in this case the collector coil was replaced by a resistor.

The selection of a power source was primarily determined by the point-contact transistor, which operated best from a six-volt source. Junction transistors, however, can be satisfactorily operated from a 1 1/2-volt source.

THE LULL in station-authorization activity continued in the early weeks of the New Year, with the blame being fired at the high-low band probe, investigation of the networks, the TV radiation study, and the satellite-booster quest. Station owners and prospective operators were simply standing by and waiting until the Commission and Congress set a policy that will hold, before they push for a license to install (and spend hundreds of thousands of dollars, too.)

The few who did follow through and receive approvals are listed on page 174 of this issue.

ELECTRONICS has become truly a magic wand for the military. To wit, at the Air Research and Development Command Wright Air Development Center, Dayton, Ohio, there's an amazing electronic problem solver, popularly known as OARAC (Office of Air Research Automatic Computer), that has saved the Air Force millions of manhours and thousands of dollars.

OARAC's brain is a whirling metallic memory drum upon which electrical impulses representing 10,000 ten-digit numbers can be stored until needed. The machine can add or subtract two 10-digit numbers in 1/11,000th of a second. It can multiply or divide these numbers in 1/200th of a second. And should an error occur during computation, one of nineteen different alarms localizes the error immediately. All thanks to the miracle of electronics.

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The MODEL W68 replaces 41 Crystal Cartridges made by the five leading manufacturers.

The W68 is a "Muted Stylus" type, Dual-Weight Cartridge. The dual weight makes it possible to replace either aluminum or steel case cartridges—without adjusting tone-arm balance. With weight slug net weight is 25 grams; without weight slug net weight is 12 grams. The W68 is equipped with the famous A62A silent-tracking, "Muted Stylus" needle. Model W68—List price.....\$7.50

The MODEL W78 replaces 149 Cartridges made by the five leading manufacturers.



Model W78 is a Dual-Volt, Dual-Weight Cartridge—so versatile it replaces 149 other cartridges! This cartridge alone will become a sensation overnight—because it replaces steel or aluminum case cartridges, of either high or low output! The W78 provides the broadest coverage at the lowest investment—only \$5.55 list.

General Information: With weight slug, net weight is 25 grams; without weight slug, net weight is 12 grams. In addition, Model W78 has a capacitor, furnished as an accessory. Without capacitor, output is 4.0 volts; with capacitor, output is 2.0 volts.



The MODEL W70 replaces 20 "Special" Cartridges.

Model W70 is a completely new cartridge in the Shure line. It replaces all the Webster "CX" and "C" Series Cartridges, comes equipped with all the necessary accessories. The W70 is more than an adequate replacement: it is an improvement, because it uses pin jacks—doing away with laborious "threading" of leads through the tone-arm. Model W70—List price.....\$4.95

SHURE *The Mark of Quality*

Technical BOOKS

"ADVANCED TELEVISION SERVICE TECHNIQUES" by RETMA Pilot Training Course Teaching Staff. Published by John F. Rider Publisher, Inc., New York, 42 pages. Price \$.95 (Laboratory Workbook) and 157 pages. Price \$3.60 (Manual).

These two volumes are the "text-books" for the RETMA Service Committee's training course which was set up for the purpose of up-grading practicing technicians, keeping practicing technicians abreast of new developments in the field, teaching practicing technicians the principles and practices of good customer relations, and instilling standards of ethics in service technicians.

The "pilot course" which was conducted at the New York Trade School in New York City has proven so successful that the present "course" is being made available to trade and vocational schools throughout the country.

This book details recent TV receiver trends and developments. The material is written in simple, easy-to-understand language. Emphasis is placed on understanding the purpose and contribution of each section of the TV receiver. Symptoms of troubles arising from defects in each section are highlighted and proper procedures for locating the faults are explained in detail.

Many technicians will meet these books through courses offered in their localities but for those who do not have an opportunity to attend such classes, these books would be of value as home-study material.

"RADIO-TELEVISION SERVICE PRICING GUIDE" compiled by Robert T. Oelrich and Harold Justice. Published by Oelrich Publications, Chicago. 44 pages. Price \$2.95. Spiral bound.

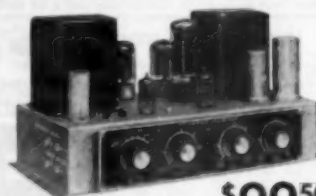
This manual is designed to improve technician-customer relations by providing tangible proof of "average" service charges prevailing in the industry.

The "averages" have been determined by canvassing service shops in Chicago which, admittedly, might result in higher figures than would apply to smaller cities and towns, but on the whole the listings provide a springboard on which the technician can base his charges.

In case the prices listed are too far out of line with local custom, the publishers have provided a duplicate set of pages without prices in which the technician can insert his own charges. The page facing the prices carries an explanation of the service involved and a "justification" for such charges, told in simple non-technical terms. Thus, the entire book is designed to be handed to the customer by the technician for his perusal and study—a

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RADIO & TELEVISION NEWS

novel and handy solution to the never-ending wrangle over charges.

"TV FIELD SERVICE MANUAL WITH TUBE LOCATIONS" by Harold Alsborg. Published by John F. Rider Publisher, Inc., New York. 121 pages. Price \$2.10. Paper bound. Vol. 3.

The third volume in this current series of manuals for technicians covers receivers made by *Emerson* and *Fada*. Like the first two volumes, for every receiver model and chassis covered there is an individual listing of trouble symptoms as well as directions for their cure. This guide of "cures" is in the form of a troubleshooting chart.

The symptoms and causes of faulty operation are covered in the early pages of the manual in the form of picture tube patterns. For each of these pictures, there is a descriptive paragraph describing the probable cause of the trouble and the circuit that should be suspected.

For each chassis there is a tube location guide, a control guide, a table of key voltages, and the set's troubles and their cures.

Those who have used the earlier volumes will welcome this book covering the *Emerson* and *Fada* sets since it is as useful as its predecessors. —50—

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ERRATA

In the article "DX'ing with the Tinytime" which appeared on page 154 of the January 1955 issue, the APC tuning capacitor, C_5 , was mentioned in the text as being a 100 μ fd. unit. The value 25 μ fd. given in the parts list is the correct value.

The article "A Semi-Automatic Tube Checker" by Phil Weiss, appearing on page 50 of the December, 1954 issue of RADIO & TELEVISION NEWS, omitted listing the input control, R_5 , setting for each tube to be tested. This list is given below:

6BA4-7	6BL7-10	6BQ7-9	7C7-4
6AC7-2	6BQ7-7	6BR7-10	7HT-10
6AG5-3	6BX7-9	6BS7-4	7J7-7
6AG7-2	6CA-10	6B8-8	7N7-10
6AH6-2	6CB6-2	6U8-8	7Q7-9
6AJ5-4	6F6-9	6V6-7	7R7-4
6AK5-3	6H6-10	6W6-10	7S7-6
6AK6-4	6J5-9	7A4-10	7V7-3
6AL5-10	6L6-9	7A5-10	7W7-7
6AT6-9	6K6-8	7A6-10	7X7-9
6AU6-4	6BA7-8	7A7-9	12AT7-7
6AV6-4	6SG7-3	7AG7-7	12AU7-10
6BA6-5	6BH7-3	7B6-8	12AV7-9
6BC5-3	6B7-5	7B6-9	12AX7-9
6BE6-7	6SK7-4	7C5-8	12BH7-10
6BJ6-3	6SL7-8	7E6-10	
6BK7-8	6SH7-9	7F7-9	

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Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
0B2	.79	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
0Z4	.54	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1A7	.83	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1AX3	.89	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1B3	.89	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1D6GT	.77	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1G4	.49	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1G6GT	.54	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1H6GT	.43	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1L4	.49	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LA4	.59	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LA6	.79	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LC5	.58	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LD5	.52	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LE3	.78	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1LN5	.57	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1P5GT	.56	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1Q5GT	.57	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1S4	.58	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1S5	.45	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1T4	.55	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1U4	.53	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1U5	.48	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1V	.49	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1X2A	.49	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
1X3	.45	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
2A6	.49	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
2A7	.44	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
2X2	.39	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
2X2A	1.85	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3A4	.44	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3A5	.90	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3A8	.60	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3B7	.59	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3D6	.38	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3L4	.79	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3Q4	.55	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3Q5GT	.69	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
354	.56	6Y4	.41	6X4	.41	6X4	.41	6X4	.41
3V4	.58	6Y4	.41	6X4	.41	6X4	.41	6X4	.41

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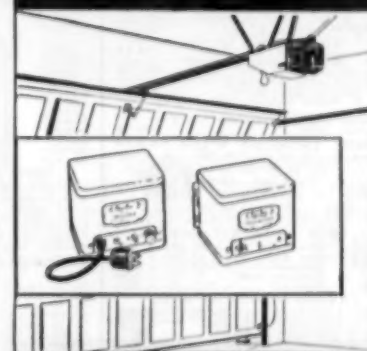
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